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1980

INTERNATIONAL PACIFIC SALMON
FISHERIES COMMISSION

APPOINTED UNDER A CONVENTION
BETWEEN CANADA AND THE UNITED STATES FOR THE
PROTECTION, PRESERVATION AND EXTENSION OF
THE SOCKEYE AND PINK SALMON FISHERIES
IN THE FRASER RIVER SYSTEM

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ANNUAL REPORT

1980

COMMISSIONERS

W. R. HOURSTON
RICHARD A. SIMMONDS
ALVIN W. DIXON

GORDON SANDISON
WILLIAM G. SALETIC
HERBERT A. LARKINS

NEW WESTMINSTER
CANADA
1981

INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

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Senator Thomas Reid	1937-1967
A. J. Whitmore	1939-1966
	1968-1969
Olof Hanson	1948-1952
H. R. MacMillan, C.B.E., D.Sc.	1952-1956
F. D. Mathers	1956-1960
W. R. Hourston	1960-
Richard Nelson	1966-1976
Roderick Haig-Brown	1970-1976
Richard A. Simmonds	1976-1980
Alvin W. Dixon	1978-

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Alvin Anderson	1949-1950
Robert J. Schoettler	1951-1957
Elton B. Jones	1951-1957
Arnie J. Suomela	1954-1961
DeWitt Gilbert	1957-1974
George C. Starlund	1961-1966
Clarence F. Pautzke	1961-1969
Thor. C. Tollefson	1966-1975
Charles H. Meacham	1969-1970
Donald R. Johnson	1971-1980
William G. Saletic	1974-
Donald W. Moos	1975-1977
Gordon Sandison	1977-
Herbert A. Larkins	1980-

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REPORT OF THE INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION FOR THE YEAR 1980

One of the little understood natural phenomena of the Fraser River sockeye runs is the variation in proportion of the run that approaches the Fraser River via Johnstone Strait as opposed to the usual majority approach through Juan de Fuca Strait. Data on the percentage of the annual Fraser River sockeye runs that approached the Fraser River via Johnstone Strait for the years 1953 to 1980 (Figure 1) show exceptionally large percentages in recent years (57% in 1978 and 70% in 1980) compared to previously recorded high values (35% in 1958 and 34% in 1972).

Previous examination of this phenomenon (Gilhousen 1960) indicated a natural periodicity of 10 or 11 years, similar to periodicity of sunspot maxima, suggesting environmental factors may be involved. Data for recent years continue to indicate this similar natural periodicity, but it is clear that the maxima in the northern approach percentage are not in proportion to the maxima of sunspot activity. Other factors must be involved, but none have been found as yet which explain fully the magnitude of the variation in the northern approach. The identification of the direct causes of the variation and the ability to predict its magnitude are very important to management, as the effect on Convention Waters fisheries can be profound.

In the early years of Commission management, starting in 1946, almost all of the allowable catch of Fraser River sockeye was taken in Convention Waters (Table 1). The exploitation of Fraser sockeye off the Vancouver Island coast, in Johnstone Strait and by the Fraser River Indian fishery in the late 1940's and early 1950's was relatively insignificant and these catches outside Convention Waters or outside Commission control had no significant impact on the Commission's management of the run. In 1946 and 1954 the Commission's regulations covered 94.9% and 97.6% of the total catch in the respective years.

Gilhousen, P. G. 1960. Migratory Behavior of Adult Fraser River Sockeye. Int. Pac. Salmon Fish. Comm. Prog. Rept. 7.

TABLE 1. Fraser Sockeye

Year	Percent of total Fraser Catch made under Commission Regulations	Percent of total Fraser Run reaching Convention Waters
1946	94.9%	96.7%
1954	97.6	99.0
1978	34.2	57.5
1980	32.2	62.2

The increasing effort and efficiency of the coastal troll fishery, Johnstone Strait net fishery and Fraser River Indian fishery in recent years has resulted in an increased percentage of the total Fraser run being removed (Figure 2). In 1978 these fisheries accounted for 45.0% of the total run and in 1980 they accounted for 43.7%. As a consequence, a lower percentage of the total run is available for catch by the traditional Convention Waters net fisheries. In each of these years the

catch of Fraser River sockeye in Johnstone Strait exceeded the catch in the traditional Convention Waters fisheries (Figure 3). This is a dramatic change from previous years of substantial northern approach. For example in 1958 the Johnstone Strait catch ratio was 0.41 of the Convention Waters catch.

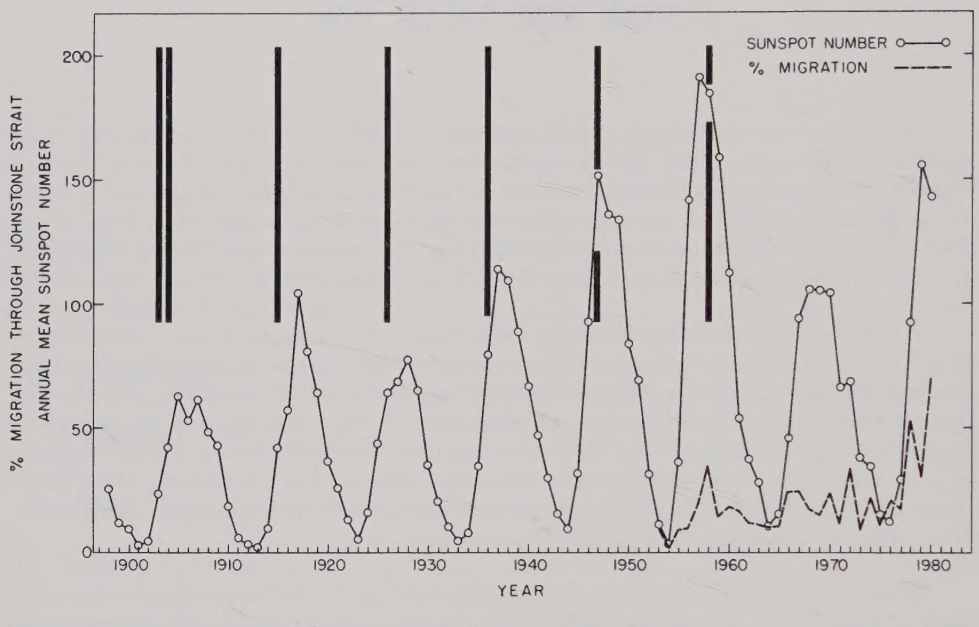

Figure 1. The proportion of Fraser River sockeye migrating through Johnstone Strait compared with annual means of sunspot numbers. Bars indicate years of heavy migration through Johnstone Strait.

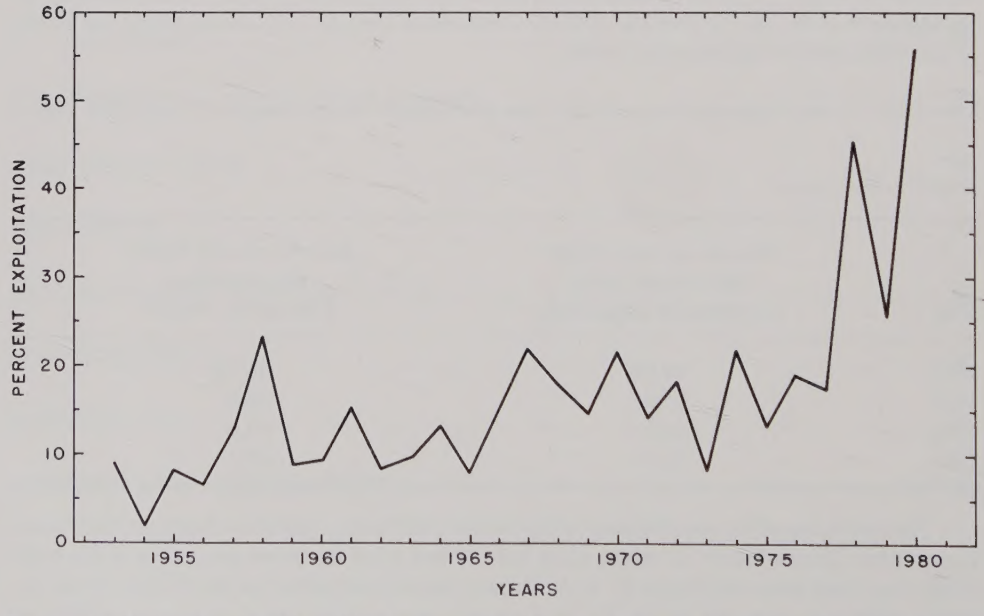

Figure 2. Combined exploitation of Fraser River sockeye outside of Convention Waters and in the Fraser River Indian fishery expressed as percent of total run.

The growth in these non-Convention Waters fisheries and the Indian fishery in Canada, coupled with the United States Government's separate regulations for Indians in United States waters, in conjunction with the exceptionally high proportion of Johnstone Strait migration, reduced the catch under Commission management in 1980 to only 32.2% of the total catch (Table 1). The catch in Convention Waters was only 918,000 out of a total run of 3.1 million, whereas the Commission had forecast a Convention Waters catch of 1.6 million out of a forecast run of 3.2 million. This had a very significant impact on Convention Waters fishermen. While it is expected

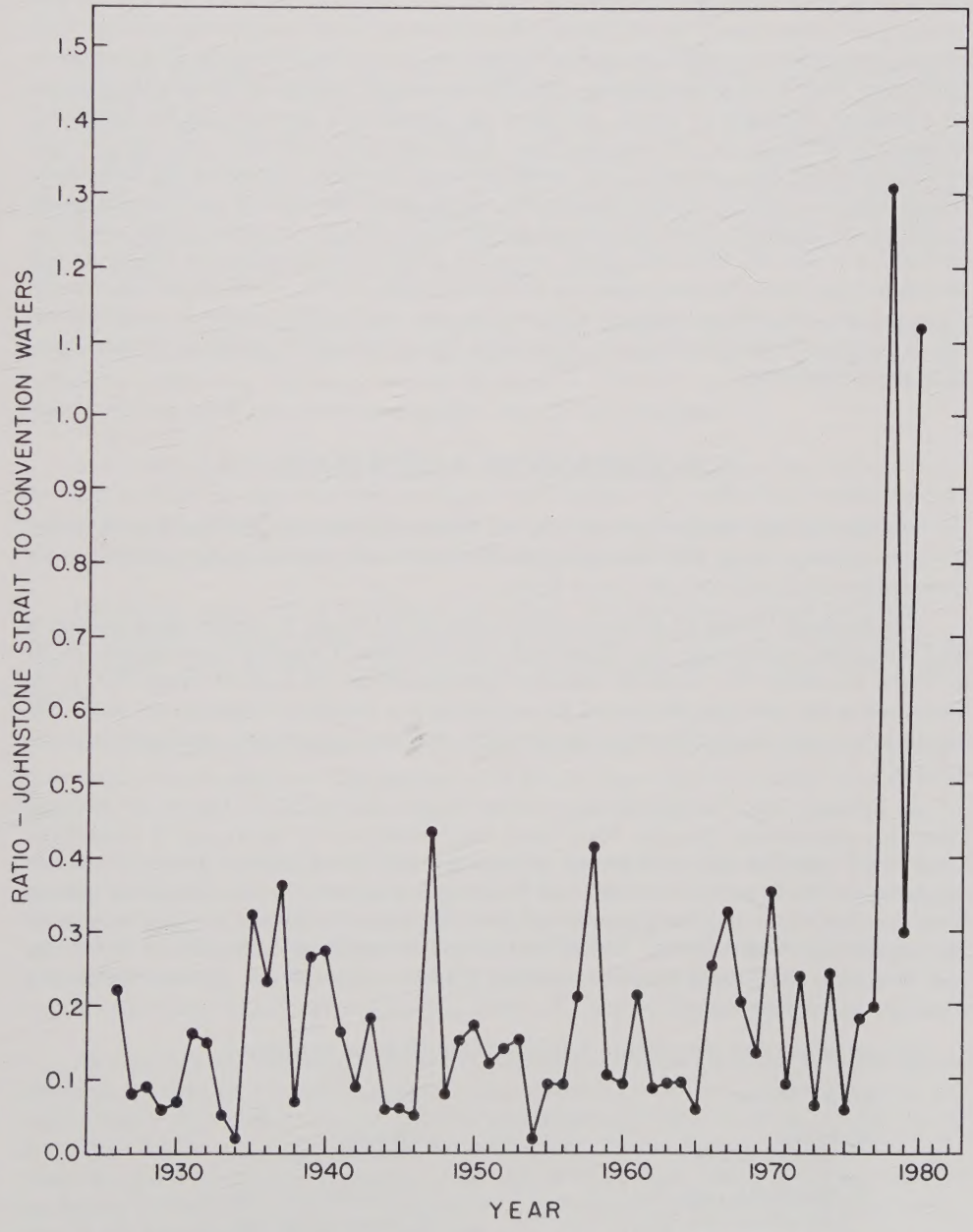

Figure 3. Ratio of Fraser River sockeye commercial catches in Johnstone Strait to catches in Convention Waters areas.

that the present high proportion of the run approaching through Johnstone Strait will reduce again if the past cyclic trend continues, the high efficiency of the fisheries on the sockeye run before they enter Convention Waters will likely be a continuing concern to the Commission in its management of the stocks. In effect there now exists major fisheries in Canadian coastal waters by trollers, and net fisheries in Johnstone Strait and in the Fraser River area by Indians. These fisheries are essentially under the control of the Canadian Government. The United States Government is managing a separate Treaty Indian fishery out of the United States share of the Convention Waters catch. The Commission manages the remainder of the allowable catch in Convention Waters for fishermen of the two countries. It is apparent that the Commission's control of the fishery has been reduced greatly and considering all fisheries where Fraser sockeye are caught, there are now three agencies regulating six general fishing areas. Clearly, this was not the intent of the Sockeye Salmon Convention when it was promulgated in 1937. This multiagency regulation increases the potential for significant management errors, and since the Commission manages the last traditional commercial fisheries as the fish near the Fraser River, the Commission has to be aware of what preceding fisheries have removed from individual races of sockeye and adjust the Convention Waters fisheries it controls to obtain escapement. Hopefully sufficient fish of each race will remain to achieve this objective. Under the present circumstances there is no assurance this will be so, especially in a year like 1980 with a large proportion of the run approaching the Fraser through Johnstone Strait when the escapement to Convention Waters may be entirely fortuitous, depending on the type of regulations adopted for harvest or conservation of other stocks. It would be desirable in such exceptional circumstances to have close liaison between the agencies in the day to day planning of regulations.

COMMISSION MEETINGS

The International Pacific Salmon Fisheries Commission held sixteen formal and twenty telephone meetings during 1980 with the approved minutes of the meetings being submitted to the Governments of Canada and the United States.

Commissioner Donald R. Johnson retired in August and Mr. H. A. Larkins was appointed to the Commission representing the United States. In December, Canadian Commissioner W. R. Hourston announced his retirement from the Commission after 20 years of service. Mr. R. A. Simmonds at the same time announced his resignation as a Canadian Commissioner because of dissatisfaction with the interference of governments with the Commission's management of the resource.

On February 2 the Commission approved the reappointment of Mr. N. Carr to the Advisory Committee representing Canadian Purse Seine Crew Members. At the August 15 meeting the Commission approved the appointments of the following United States Advisory Committee members: Mr. W. Green representing Purse Seine Fishermen, Mr. J. Lind representing Salmon Processors and Mr. E. Engman representing Sports Fishermen. On December 5 the Commission approved the appointments of Mr. R. Christensen representing United States Gill Net Fishermen, Mr. B. Fraser representing Canadian Salmon Processors and Mr. A. Downs representing Canadian Sports Fishermen.

The membership of the Advisory Committee for 1980 was as follows:

United States	*Canada*
W. Green Purse Seine Fishermen	J. Brajcich Purse Seine Fishermen
D. Franett (to Aug. 14)	J. O'Conner (to Dec. 4)
J. Lind (from Aug. 15) Salmon Processors	B. Fraser (from Dec. 5) Salmon Processors

R. Christensen
Gill Net Fishermen

T. Philpott
Reef Net Fishermen

G. Simmons
Troll Fishermen

E. Engman
Sports Fishermen

F. Nishii
Gill Net Fishermen

N. Carr
Purse Seine Crew Members

J. Makowichuk
Troll Fishermen

H. English (to Dec. 4)
A. Downs (from Dec. 5)
Sports Fishermen

The first meeting of 1980 was held February 5 with Mr. Gordon Sandison serving as Chairman and Mr. W. R. Hourston as Vice-Chairman and Secretary. The Commission met with its Advisory Committee regarding the tentative recommendations for regulatory control of the 1980 sockeye salmon fishery in Convention Waters, as submitted to the Committee on December 7, 1979. After certain regulatory revisions, the Commission approved the recommended regulations for submission to the two national governments. Mr. Hourston advised of proposals of the Department of Fisheries and Oceans regarding the Commission's proposed restrictions of the Fraser River Indian fisheries during the migration of Early Stuart sockeye.

On May 1 the Commission met at Sweltzer Creek Research Laboratory to view various research activities. On May 2 the Commission met at Harrison Hot Springs and approved a revised budget for 1980-81 and the budget request for fiscal year 1981-82. A draft of the 1979 Annual Report was approved and other administrative matters were discussed.

At its meeting of July 18 the Commission approved budgetary matters concerning a survey on the Nechako River in connection with the Aluminum Company of Canada plans to reduce greatly spills from their reservoir this year. Funds for the removal of gravel deposits from Weaver and Sakwi Creeks resulting from floods during 1979 were also approved.

During the period July 25 to October 10 inclusive, the Commission held eleven formal and twenty telephone meetings for adjustment of fishing regulations to achieve the desired escapement and, as nearly as practicable, equitable division of the allowable catch of Fraser River sockeye salmon.

The Commission on September 5 approved the addition of 26,000 sockeye to Canadian Convention Waters catch and 6,000 sockeye to the United States catch for sockeye taken home or sold.

On September 24 the Commission inspected the sockeye spawning in Chilko River. At its meeting of October 10 the Commission discussed various aspects of potential overescapement to Weaver Creek. The Commission approved letters to be sent to governmental departments concerning the 1981 west coast troll regulations. The Commission met December 5 to review the Annual Meeting presentation and approved a letter to the Minister of the Department of Fisheries and Oceans concerning the adoptation and enforcement of Commission regulations.

The sixteenth and final formal meeting of the year was held on December 12 in Bellingham, Washington, when the Commission held its Annual Meeting with its Advisory Committee and approximately 300 representatives of industry, government and press. A review of events during the sockeye salmon season was presented by the Chairman. The catch and escapement statistics for 1980 were given by the staff. Prospects for the 1981 fishing season were reviewed and tentative regulations for the 1981 fishery were proposed for consideration by industry and their representatives on the Commission Advisory Committee.

1980 REGULATIONS

Recommendations for regulations governing the 1980 sockeye salmon fishery in Convention Waters were adopted at a meeting of the Commission held February 5, 1980 and were submitted to the two national governments for approval on March 24, 1980. On May 22, 1980 the United States Government informed the Commission that its recommended 1980 regulations were approved with the exception that certain Treaty Indians were excluded and would be regulated under separate United States regulations. The National Marine Fisheries Service was designated as the enforcing agency in cooperation with other federal agencies. The recommendations for Canadian Convention Waters were implemented during the fishing season under the Fisheries Act, Pacific Commercial Salmon Fishery Regulations and subsequently by Order-in-Council dated August 27, 1980.

The recommendations of the Commission were as follows:

Canadian Convention Waters

The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries of the Fraser River System, signed at Washington on the 26th day of May, 1930, as amended by the Pink Salmon Protocol signed at Ottawa on the 28th day of December, 1956, hereby recommends to the Canadian Government that, in the interests of such fisheries, the following Fraser River Sockeye and Pink Salmon Fishery Regulations for Convention Waters for the season of 1980 be adopted by Order-in-Council pursuant to Section 34 of the Fisheries Act, namely:

1. (1) No person shall fish for sockeye or pink salmon in the waters of the southerly portion of District No. 3 in that portion of Area 20 lying westerly of a line drawn true south from Sheringham Point Lighthouse to the International Boundary with nets from the 22nd day of June, 1980 to the 26th day of July, 1980, both dates inclusive.

(2) No person shall fish for sockeye or pink salmon with purse seines in the waters described in subsection (1) of this section from the 27th day of July, 1980 to the 30th day of August, 1980, both dates inclusive, except from half past six o'clock in the forenoon to half past six o'clock in the afternoon of Monday of each week.

(3) No person shall fish for sockeye or pink salmon with gill nets in the waters described in subsection (1) of this section from the 27th day of July, 1980 to the 30th day of August, 1980, both dates inclusive, except from half past six o'clock in the afternoon of Sunday to half past six o'clock in the forenoon of Monday of each week.

(4) No person shall troll commercially for sockeye or pink salmon in the waters described in subsection (1) of this section from the 27th day of July, 1980 to the 30th day of August, 1980, both dates inclusive, except at times that net fishing may be permitted within that area.

2. No person shall fish for sockeye or pink salmon with nets in the waters of the southerly portion of District No. 3 embraced in Areas 17 and 18:

(1) From the 22nd day of June, 1980 to the 19th day of July, 1980, both dates inclusive; and

(2) From the 20th day of July, 1980 to the 9th day of August, 1980, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week; and

(3) From the 10th day of August, 1980 to the 4th day of October, 1980, both dates inclusive.

3. No person shall troll commercially for sockeye or pink salmon in that portion of the waters described in section 2 lying easterly of a straight line from Thrasher Rock Light to Salamanca Point on the southerly end of Galiano Island, thence in a straight line to East Point on Saturna Island, thence due south to the International Boundary, from the 10th day of August, 1980 to the 4th day of October, 1980, both dates inclusive.

4. No person shall fish for sockeye or pink salmon with gill nets in District No. 1:

(1) From the 22nd day of June, 1980 to the 19th day of July, 1980, both dates inclusive; and

(2) From the 20th day of July, 1980 to the 13th day of September, 1980, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week; and

(3) From the 14th day of September, 1980 to the 4th day of October, 1980, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week, in those waters lying westerly of a line projected from Point Grey to the westerly end of the North Arm Jetty, thence to Sand Heads Light, thence to Canoe Pass Buoy, thence to the light on the westerly end of Tsawwassen Causeway and thence to the Point Roberts Light in the State of Washington; and

(4) From the 5th day of October, 1980 to the 11th day of October, 1980, both dates inclusive, in those waters lying easterly of a line projected from Point Grey to the westerly end of the North Arm Jetty, thence to Sand Heads Light, thence to Canoe Pass Buoy, thence to the light on the westerly end of Tsawwassen Causeway and thence to the Point Roberts Light in the State of Washington.

5. (1) No person shall troll commercially for sockeye or pink salmon in those waters described in section 4 from the 10th day of August, 1980 to the 4th day of October, 1980, both dates inclusive, except at times that net fishing may be permitted within that area.

(2) No person shall troll commercially for sockeye or pink salmon in those waters described in subsection (4) of section 4 from the 5th day of October, 1980 to the 11th day of October, 1980, both dates inclusive, except at times that net fishing may be permitted within that area.

All times hereinbefore mentioned shall be Pacific Daylight Saving Time.

United States Convention Waters

The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries of the Fraser River System, signed at Washington on the 26th day of May, 1930, as amended by the Pink Salmon Protocol signed at Ottawa on the 28th day of December, 1956, hereby recommends to the United States Government that regulations to the following effect, in the interests of such fisheries in Convention Waters, be adopted for the year 1980, and that an approved copy of said regulations be forwarded to the Director of Fisheries of the State of Washington for implementation by virtue of authority in him vested by Section 6 of Chapter 112 of the Laws of the State of Washington of 1949, namely:

1. No person shall fish for sockeye or pink salmon with nets from the 22nd day of June, 1980 to the 19th day of July, 1980, both dates inclusive.

2. (1) No person shall fish for sockeye or pink salmon with purse seines in Puget Sound Salmon Management and Catch Reporting Areas 4B, 5 and 6C:

(a) From the 20th day of July, 1980 to the 16th day of August, 1980, both dates inclusive, except from five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday of each week; and

(b) From the 17th day of August, 1980 to the 30th day of August, 1980, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday of each week.

(2) No person shall fish for sockeye or pink salmon with gill nets in the waters described in subsection (1) of this section:

(a) From the 20th day of July, 1980 to the 26th day of July, 1980, and from the 3rd day of August, 1980 to the 9th day of August, 1980, all dates inclusive, except from seven o'clock in the afternoon of Monday to half past nine o'clock in the forenoon of Tuesday of each week; and

(b) From the 27th day of July, 1980 to the 2nd day of August, 1980, and from the 10th day of August, 1980 to the 16th day of August, 1980, all dates inclusive, except from seven o'clock in the afternoon of Sunday to half past nine o'clock in the forenoon of Monday of each week; and

(c) From the 17th day of August, 1980 to the 23rd day of August, 1980, both dates inclusive, except from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday; and

(d) From the 24th day of August, 1980 to the 30th day of August, 1980, both dates inclusive, except from six o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday.

(3) No person shall fish for sockeye or pink salmon with commercial trolling gear in the waters described in subsection (1) of this section from the 20th day of July, 1980 to the 30th day of August, 1980, both dates inclusive, except from Monday through Friday of each week on those days when purse seine fishing is permitted within that area.

3. (1) No person shall fish for sockeye or pink salmon with purse seines in Puget Sound Salmon Management and Catch Reporting Areas 6, 6A, 7, 7A and 7D:

(a) From the 20th day of July, 1980 to the 16th day of August, 1980, both dates inclusive, except from five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday of each week; and

(b) From the 17th day of August, 1980 to the 6th day of September, 1980, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday of each week.

(2) No person shall fish for sockeye or pink salmon with reef nets in the waters described in subsection (1) of this section:

(a) From the 20th day of July, 1980 to the 26th day of July, 1980, from the 3rd day of August, 1980 to the 9th day of August, 1980, and from the 17th day of August, 1980 to the 23rd day of August, 1980, and from the 31st day of August, 1980 to the 6th day of September, 1980, all dates inclusive, except from half past six o'clock in the forenoon to eight o'clock in the afternoon of Sunday of each week; and

(b) From the 27th day of July, 1980 to the 2nd day of August, 1980, and from the 10th day of August, 1980 to the 16th day of August, 1980, all dates inclusive, except from half past seven o'clock in the forenoon to half past nine o'clock in the afternoon of Sunday of each week; and

(c) From the 24th day of August, 1980 to the 30th day of August, 1980, both dates inclusive, except from half past seven o'clock in the forenoon to nine o'clock in the afternoon of Sunday.

(3) No person shall fish for sockeye or pink salmon with gill nets in the waters described in subsection (1) of this section:

(a) From the 20th day of July, 1980 to the 26th day of July, 1980, and from the 3rd day of August, 1980 to the 9th day of August, 1980, all dates inclusive, except from seven o'clock in the afternoon of Monday to half past nine o'clock in the forenoon of Tuesday of each week; and

(b) From the 27th day of July, 1980 to the 2nd day of August, 1980, and from the 10th day of August, 1980 to the 16th day of August, 1980, all dates inclusive, except from seven o'clock in the afternoon of Sunday to half past nine o'clock in the forenoon of Monday of each week; and

(c) From the 17th day of August, 1980 to the 23rd day of August, 1980, and from the 31st day of August, 1980 to the 6th day of September, 1980, all dates inclusive, except from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday of each week; and

(d) From the 24th day of August, 1980 to the 30th day of August, 1980, both dates inclusive, except from six o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday.

4. (1) No person shall fish for sockeye or pink salmon with nets in that portion of the waters described in subsection (1) of section 3 lying northerly and westerly of a straight line drawn from Iwersen's Dock on Point Roberts in the State of Washington to Georgina Point Light at the entrance to Active Pass in the Province of British Columbia from the 31st day of August, 1980 to the 6th day of September, 1980, and from the 14th day of September, 1980 to the 20th day of September, 1980, all dates inclusive.

(2) No person shall fish for sockeye or pink salmon with nets in that portion of the waters described in subsection (1) of section 3 lying westerly of a straight line drawn from the low water range marker in Boundary Bay on the International Boundary through the east tip of Point Roberts in the State of Washington to the East Point Light on Saturna Island in the Province of British Columbia from the 7th day of September, 1980 to the 13th day of September, 1980, both dates inclusive.

5. The foregoing recommended regulations shall not apply to the following waters:

(1) Puget Sound Salmon Management and Catch Reporting Areas as follows:

(a) Commencing July 20, 1980, Area 7B.

(b) Areas 6B and 7C.

(2) Preserves previously established by the Director of Fisheries of the State of Washington for the protection of other species of food fish.

All times hereinbefore mentioned shall be Pacific Daylight Saving Time.

Emergency Orders

In order to provide for adequate racial escapement of Fraser River sockeye salmon and for an equitable share of the season's catch by fishermen of the United States and Canada, the approved regulations as detailed above were later adjusted by the Commission as follows.

July 25, 1980 — In the interest of securing additional escapement of early summer sockeye runs the Commission approved that United States Convention Waters and District No. 1, Areas 17 and 18 of Canadian Convention Waters not open as scheduled for the week commencing July 27.

August 8, 1980 — In the interest of harvesting Chilko River sockeye the Commission approved advancing the opening of Area 20 of Canadian Convention Waters for the week commencing August 10 by 24 hours for two days of fishing.

August 11, 1980 — In the interest of division of catch and harvest of sockeye the Commission approved an additional one day of fishing in United States Convention Waters making two days fishing for the current week.

August 15, 1980 — In the interest of division of catch and for obtaining escapement of Chilko River sockeye currently in District No. 1 the Commission approved the following changes in regulations: 1) That United States Convention Waters opening be advanced 24 hours for two days of fishing for the week commencing August 17. 2) That Canadian Convention Waters not open as scheduled for the week commencing August 17.

August 17, 1980 — In the interest of harvesting Chilko River sockeye the Commission approved opening District No. 1 of Canadian Convention Waters for 24 hours of fishing on August 19.

August 18, 1980 — In the interest of division of catch the Commission approved two additional days of fishing in United States Convention Waters making a total of four days fishing for the current week.

August 20, 1980 — In the interest of harvesting Chilko River sockeye and division of catch the Commission approved opening District No. 1 of Canadian Convention Waters, on August 22 for 1 day of fishing, making a total of two days for the week.

August 22, 1980 — In the interest of division of catch the Commission approved that all United States Convention Waters not open as scheduled for the week commencing August 24.

August 25, 1980 — Because of declining abundance of sockeye in Juan de Fuca Strait and for division of catch the Commission approved the following regulatory changes: 1) That control of Area 20 of Canadian Convention Waters be relinquished effective 6:30 p.m. August 25. 2) That District No. 1 of Canadian Convention Waters westerly of the Brunswick Cannery-Oak Street Bridge Line open 8:00 a.m. August 26 for 24 hours of fishing. 3) That control of Areas 4B, 5, 6C of United States Convention Waters be relinquished effective 6:00 p.m. August 25. 4) That Areas 6, 6A, 7 and 7A of United States Convention Waters be closed until further notice.

August 26, 1980 — In the interest of additional harvest of Chilko River sockeye the Commission approved opening District No. 1 of Canadian Convention Waters westerly of the Brunswick Cannery-Oak Street Bridge Line from 8:00 a.m. August 27 for two days of fishing, making a total of four days for the week.

August 29, 1980 — Due to declining numbers of sockeye salmon approaching the Fraser River the Commission relinquished regulatory control of United States Convention Waters southerly of Iwersen's Dock Line effective 12:01 a.m. August 31.

September 3, 1980 — In the interest of additional harvest of Chilko River and Birkenhead River sockeye the Commission approved opening District No. 1 of Canadian Convention Waters westerly of the Brunswick Cannery-Oak Street Bridge Line at 8:00 a.m. September 4 for 24 hours.

September 5, 1980 — In the interest of division of catch the Commission approved the following changes in regulations: 1) That District No. 1 of Canadian Convention Waters westerly of the Blue Line open for fishing at 7:00 p.m. September 9 to 8:00 a.m. September 10. 2) That United States Convention Waters northerly of the Iwersen's Dock Line remain closed.

September 10, 1980 — In the interest of additional harvest of Weaver Creek sockeye the Commission approved opening District No. 1 of Canadian Convention Waters westerly of the Blue Line from 7:00 p.m. September 11 to 8:00 a.m. September 12.

September 12, 1980 a.m. — In the interest of harvesting Weaver Creek sockeye the Commission approved opening District No. 1 of Canadian Convention Waters westerly of the Blue Line from 7:00 p.m. September 15 to 8:00 a.m. September 16, and from 7:00 p.m. September 16 to 8:00 a.m. September 17.

September 12, 1980 p.m. — The Commission approved opening Areas 17 and 18 of Canadian Convention Waters easterly of a line from Thrasher Rock Light, thence to Salamanca Point on Galiano Island, thence to East Point on Saturna Island, thence due south to the International Boundary for:

1) Trolling from 7:00 a.m. to 7:00 p.m. September 15.

2) Gill Nets from 7:00 p.m. September 15 to 7:00 a.m. September 16.

3) Purse Seines from 7:00 a.m. to 7:00 p.m. September 16.

September 17, 1980 — In the interest of harvesting Weaver Creek sockeye the Commission approved opening District No. 1 of Canadian Convention Waters northerly and westerly of a line from Point Grey, thence to the westerly end of the North Arm Jetty, thence to Sand Heads Light, thence to Thrasher Rock Light from 7:00 p.m. September 17 to 8:00 a.m. September 18.

September 19, 1980 — In the interest of additional harvest of Weaver Creek sockeye the Commission approved opening District No. 1 of Canadian Convention Waters northerly and westerly of a line from Point Grey, thence to the westerly end of the North Arm Jetty, thence to Sand Heads Light, thence to Thrasher Rock Light from 7:00 p.m. September 23 to 8:00 a.m. September 24.

September 26, 1980 — In order to optimize the harvest of Weaver Creek sockeye at a later date, the Commission approved that District No. 1 of Canadian Convention Waters not open as scheduled for the week commencing September 28.

October 3, 1980 — In the interest of securing escapement of Weaver Creek sockeye the Commission approved that District No. 1 of Canadian Convention Waters remain closed for the week commencing October 5.

October 6, 1980 — In the interest of harvesting Weaver Creek sockeye and division of catch the Commission approved opening District No. 1 of Canadian Convention Waters easterly of the Blue Line from 7:00 a.m. to 7:00 p.m. October 7, and relinquished control of the waters of District No. 1 westerly of the Blue Line effective 12:01 a.m. October 8.

The Commission relinquished regulatory control of the remaining Convention Waters effective October 12 as scheduled, thus completing the Commission's regulatory obligations for Convention Waters for the 1980 season.

During the 1980 sockeye season in Convention Waters, action by the two national governments resulted in modification of the Commission's management plan and resulted in the need for emergency regulations to achieve the desired catch and escapement. During the period from July 20 to August 30 the United States Government permitted certain Treaty Indian Tribes to fish for sockeye salmon on days other than those allotted by the Commission. A total of 25 fishing periods were permitted for Treaty Indian gill nets in Areas 4B and 5 and in Areas 6-7, 18 fishing periods were given for Treaty Indian purse seines and 19 fishing periods for Treaty Indian gill nets whereas, under Commission regulations 8 fishing periods were permitted for each gear.

Within Canadian Convention Waters the Canadian Government modified Commission regulations pertaining to the District No. 1 fishery on two occasions and cancelled fisheries on two other occasions between July 20 and September 17.

The action of the United States Government had the effect of increasing the fishing effort and catch of sockeye in United States Convention Waters while that of the Canadian Government resulted in a reduced fishing effort and catch in Canadian Convention Waters.

SOCKEYE SALMON REPORT

The Fishery

The total 1980 Fraser River sockeye run was estimated at 3,136,000 fish compared with a preseason forecast of 3,200,000. The total return was close to the cycle average of 3,180,000 sockeye for the period 1952-1976. The number of Fraser sockeye entering Convention Waters was 1,951,000 of which 916,000 (46.9%) were caught commercially, 186,283 (9.6%) were taken by the Indian fishery, and 848,320 (43.5%) were recorded on the spawning grounds (see Tables I to VI in Appendix). An estimated 6,000 non-Fraser sockeye, mainly from the run to Cedar River in Washington State, were also caught in Convention Waters. The estimated catches of Fraser River sockeye in non-Convention Waters in Johnstone Strait and northern Strait of Georgia, and coastal waters north of

Convention Waters, were 1,094,000 and 92,000 respectively. The non-Convention Waters catch of Fraser sockeye migrating through Johnstone Strait was 34.9% of the total run, compared with 11.3% in 1976, the preceding cycle year.

The total 1980 Convention Waters catch of sockeye was only 922,331 fish, the lowest catch of any year on the cycle since 1888, and only about one-third as large as in 1976, the brood year. With respect to all years, the 1980 catch was the lowest since 1947, when complete early season closures were imposed until August 18. The extremely low Convention Waters catch in 1980 was directly related to record high migration of Fraser River sockeye through Johnstone Strait that reached an estimated 70% of the total Fraser run. High percentages of the total Fraser River sockeye run have migrated through Johnstone Strait for three consecutive years with an estimated 57% in 1978, 30% in 1979, and the record 70% migration in 1980. In 1978 about 42.5% of the total Fraser run was caught outside Convention Waters followed by 20.9% in 1979 and 37.8% in 1980.

Despite the unusual circumstances surrounding the 1980 season, most of the Commission's obligations under the Convention were met. However, the potential for serious management errors exist when the Commission's control of the fisheries is diminished to the extent that it has in recent years. If restraint in fishing time in one particular week in Johnstone Strait had not been implemented by the Department of Fisheries and Oceans during 1980, a very serious management problem with respect to the Fraser sockeye run would very likely have occurred.

Within Convention Waters, Canadian fishermen caught 456,158 sockeye (49.46%) and United States fishermen caught 466,173 sockeye (50.54%) (Appendix Tables I and II).

In Canadian Convention Waters, 130,006 (28.5%) sockeye were taken in the waters westerly of William Head, while 326,117 sockeye (71.5%) were caught easterly of William Head, almost all of which were taken in the Fraser River area. Only 6,908 (1.5%) sockeye were taken in the Convention Waters west coast troll fishery and the low catch in that fishery as well as in Area 20 was attributable to the record low percentage of the sockeye run that was available to trollers on the outside coast of Vancouver Island. The purse seine catch in Area 20 was only 69,853 sockeye with a maximum of only 48 boats participating. Gill nets in all of Canadian Convention Waters caught only 379,367 sockeye (83.2%), which was the lowest catch on the cycle since 1928. The purse seine catch was the smallest on the cycle since 1968.

In United States Convention Waters, the purse seine catch of only 189,899 sockeye was the lowest on the cycle back to at least 1936. The downward trend in percentage of catch taken by purse seines continued in 1980 reaching the lowest level on record (40.7%) back to 1935. The gill net catch of 263,139 sockeye (56.5%) was the lowest of any year back to 1965, however, the percentage taken was the largest of any year to date. Reef nets caught only 13,050 sockeye (2.8%) and this was the lowest catch in any year since 1947 and the lowest on the cycle since at least 1936. The normal proportion of the total run available to United States fishermen was greatly reduced in 1980 because the majority of the sockeye run migrated through Johnstone Strait and catches vividly reflected this situation.

Fishing effort (total units fishing) during the season in Canadian Convention Waters (Table 2) was considerably reduced in 1980 compared with other cycle years as a result of the expected average return of sockeye on this low abundance cycle associated with the abnormally high percentage migration of Fraser sockeye through Johnstone Strait. The amount of gear fishing in United States Convention Waters was also reduced for the same reasons as previously outlined but in addition, the excellent runs to many Alaskan areas also attracted United States fishermen to those northern fishing areas.

TABLE 2. Fishing units operating in Convention Waters

	1972	1976	1980
Canadian Convention Waters			
Purse Seines Area 20	47	101	48
Gill Nets	1,004	766	607
	1,051	867	655
United States Convention Waters			
Purse Seines	117	193	157
Gill Nets	565	789	744
Reef Nets	46	45	46
	728	1,027	947

The Chilko River run was, as expected, the major producer in 1980 reaching about 1,800,000 sockeye, or about 57% of the total run. The total Chilko return was slightly larger than the predicted run of 1,500,000 fish. The Birkenhead River population produced exceptionally well with a total return of about 500,000 sockeye. The Stellako run produced about 300,000 fish and Weaver Creek produced about 250,000 fish. The Gates Creek return of about 63,000 sockeye was somewhat disappointing since the brood year fry production from the spawning channel was the largest of any year.

Timing of the Chilko run in 1980 was about ten days later than average with the peak arriving at the mouth of the Fraser River on about August 16.

For the fourth consecutive year, the United States Government adopted separate regulations for certain Indian Tribes which provided fishing in United States Convention Waters when the waters were closed under Commission regulations. In 1980, the Commission's regulations authorized a total of eight separate fishing periods in Areas 6, 6A, 7 and 7A. The United States Government allowed Treaty Indians an additional 11 fishing periods for gill net and 10 periods for purse seine.

In Areas 4B, 5 and 6C, Commission regulations specified a total of eight separate fishing periods, whereas the United States Government independently granted 16 extra fishing periods. Approximately 180,000 sockeye were caught during these periods when United States Convention Waters were closed to fishing under Commission regulations.

The Canadian Government on several occasions during the 1980 season altered Commission regulations ranging from reducing fishing area to cancelling fishing days thereby limiting the catch of sockeye below the desired exploitation rate. These actions affected division of catch between the United States and Canada and also resulted in excessive escapement at Weaver Creek and more than the desired escapement at Chilko River.

The 1980 sockeye were very small with an average weight of 5.2 pounds for four-year-old fish, the second smallest average weight recorded for the cycle from 1916 to 1980.

Escapement

The net escapement of 848,320 sockeye represented 43.5% of the 1980 Fraser run to Convention Waters and 27.1% of the calculated total Fraser River run. The total escapement was the largest on the cycle since 1956 and similar to the last two cycle years. For all races, there was about the same number of stocks that showed improvement or decline in escapement in 1980 as in the brood year.

Efforts were made to increase significantly the Early Stuart escapement, however, this was not accomplished because the total run was not as large as predicted and suggested closures in the Fraser River Indian fishery were not implemented fully. The total escapement reaching the spawning grounds was 17,026 compared with 12,648 in 1976 and was the largest on the cycle since 1956. However, with the total 1980 run estimated at about 29,000 sockeye and with complete closure of the commercial fishery in Convention Waters, a larger escapement could have been achieved. Additionally, a 25% prespawning mortality was observed, further reducing the potential for 1984 and thereby increasing the likelihood of extensive closures in that year.

The Late Stuart escapement showed a sharp decline to 979 sockeye compared to 3,000 in 1976. The decline in this race on this cycle is of concern as the escapement in 1972 was 8,704.

The Seymour River escapement of 8,390 sockeye was almost the same as in the brood year (8,489). Other South Thompson district summer run races producing on the 1980 cycle are the Momich River-Cayenne Creek run where a record escapement of 3,345 spawners was observed and the Upper Adams River which had an escapement of 560 sockeye, the largest on record since the Hell's Gate slide.

In the North Thompson district, the Raft River race declined to 5,418 spawners compared with 8,684 spawners in 1976. The Fennell Creek population had the largest escapement for the cycle increasing from 4,090 sockeye in 1976 to 8,437 spawners in 1980.

The Chilko River escapement of 468,658 sockeye was larger than the preseason goal of 400,000 fish. However, the escapement was not considered excessive.

The time and success of spawning were normal. The south end Chilko Lake population increased from 23,156 spawners in 1976 to 30,168 fish in 1980.

The Birkenhead River total escapement was 90,922 in 1980 compared with 108,121 spawners in 1976. Although the total escapement this year was less than four years ago, the numbers of adult spawners (78,613) was slightly more than observed in 1976 (77,305). A prespawning loss of 25% was recorded, some of which is attributable to snagging and discarding of sockeye by local Indian residents. A severe flood in December, 1980, will have a serious impact on the returning run in 1984.

The Bowron River escapement of 2,894 showed an improvement over the number (2,250) observed in 1976.

The Early Nadina escapement increased from 101 fish in 1976 to 205 spawners in 1980 reversing a downward trend that had existed on the cycle dating back to 1964. The Late Nadina escapement of 3,079 (including 3,021 in the spawning channel) was about double the brood year and the largest on record for the cycle. The advantage received from the spawning channel in 1975 and 1976 is evident. Almost 58% of the return were five-year-olds from 1975 spawning, the same

brood that produced the record 1979 run. The Stellako River escapement in 1980 was only 72,073, less than one-half the brood year level. In addition, a loss of about 27% of the females due to prespawning mortality occurred. About 22% of the escapement was comprised of five-year-olds from the record 1975 brood year production.

The escapement to Gates Creek was 25,494 sockeye, the largest on record and record numbers (21,140) went into the spawning channel. A prespawning loss of about 26% occurred.

A substantial decline in escapement occurred at Pitt River with 17,135 spawners in 1980 compared with over twice as many (36,530) in 1976.

The late run sockeye escapement into Lower Adams River of 2,560 fish was only about one-half the escapement (5,130) observed in 1976. At Portage Creek the total escapement including jack sockeye declined from 3,800 spawners in 1976 to 1,998 fish in 1980; however, the number of adult sockeye increased to 1,800 spawners compared with about 1,000 in 1976.

Late run escapements into the lower Fraser River areas ranged from poor to above desired levels of abundance. The Cultus Lake escapement in 1980 was only 1,687 fish which continues the progressive decline in production on this cycle since the 1968 escapement of 25,736 spawners. The Harrison River escapement of 5,092 sockeye in 1980 maintained the trend of low to moderate escapements observed at these spawning grounds in recent years with the exception of 1979.

The Weaver Creek escapement of 74,839 was the largest recorded on the cycle and was about 35,000 larger than desired. Because of annual flooding of Weaver Creek and resulting low egg to fry survival from the natural spawning grounds, 41,595 sockeye were allowed into the spawning channel in an effort to make effective use of the large escapement.

The Indian subsistence catch was estimated at 186,283 sockeye, lower than the record cycle catch of 228,798 made in 1976.

The total escapement in 1980 contained the largest number of effective female spawners on the cycle since 1956 with the Chilko River population forming 61.8% of the total. Effort has been directed toward increasing the escapement of other stocks to reduce reliance on the Chilko River race as the primary producer on this cycle. In 1976 Chilko river escapement formed only 49.1% of the total effective female spawners compared with 78.1% in 1972. The increased percentage in 1980 was attributable, in part, to the reduced fishing effectiveness of the Fraser River commercial fishery and also because the local Chilcotin area Indian fishery catches in 1980 were about 27,000 fewer than in 1976.

Echo sounding on the Fraser River was again conducted in the summer of 1980 to estimate the daily sockeye escapement past Mission. The gross in-season adult escapement estimate was 15.4% higher than the recorded escapements to the spawning grounds plus Indian fishery catch. In addition, an experimental downward-looking stationary echo sounder was tested for short periods. This sounder was shifted periodically in a stratified random sampling scheme along a transect above the Mission Bridge to test the effectiveness of this method compared to the more expensive mobile method now used.

SPAWNING CHANNEL OPERATIONS

Fry production from the 1979 spawning of sockeye and pink salmon at channels operated by the Commission totalled 75 million (Table 3).

TABLE 3. Sockeye and pink salmon fry production from the 1979 brood at spawning and incubation channels.

Site	Species	Eggs Deposited	Fry Produced	Percent Survival
Upper Pitt	sockeye	4,631,000*	3,397,000	73.4
Weaver Creek	sockeye	47,897,000	26,674,000	55.7
Gates Creek	sockeye	5,110,000	2,896,000	56.7
Nadina River	sockeye	41,349,000	19,162,000	46.3
Upper Seton	pink	9,915,000	4,527,000	45.7
Lower Seton	pink	33,445,000	18,595,000	55.6

* eggs taken

At Upper Pitt the fry output was about 14% above average but the survival from eggs taken was below the 19 year average of 80.3%. At Weaver Creek the number of fry was the largest yet on the cycle, but had been purposely limited as reported last year. Fry output from the Gates Creek channel was also the largest yet on the cycle. Egg to fry survival was lower than in previous cycle years, probably indicating the gravel needed cleaning. As reported elsewhere this was done prior to the 1980 adult return. The Nadina channel fry production was the largest on any cycle, and was 1.6 times larger than in 1975. The accumulated data for the seven years of operation of this channel now suggest the increasing density of spawners is affecting the efficiency of fry production (Figure 4). This is in contrast to the results at the Weaver Creek channel, where such effect has not been indicated yet for even higher density of spawners. At the two pink salmon channels at Seton Creek, density of female spawners in 1979 was purposely limited to approximately 1 female per sq. yd. Results indicate no effect on efficiency of fry production up to this density of spawners. Fry output from the lower channel was the second largest in the seven cycles of operation.

The total Pitt River sockeye return in 1980 was estimated at 32,400, of which 12,000 were produced by the incubation channel. The total run was the smallest since 1952, (Figure 5), even though the number of fry produced by the river and channel was the largest in 20 years. Additional returns of five-year-old sockeye are expected in 1981. The total Weaver Creek sockeye return was estimated at 253,000, of which 232,000 were produced by the spawning channel. The total run was about the same as in 1976 (Figures 6 and 7), although the number of fry was three times larger than for the brood year. The total Gates Creek sockeye return was estimated at 63,000, of which 96% were produced by the spawning channel. This return was only about half that of the previous cycle in 1976, even though the number of fry was nearly three times larger. The low returns to Weaver Creek and Gates Creek may be partly attributable to very early timing of the fry emergence and low marine survival. The 1980 Weaver Creek return necessitates reappraisal of previous assessment of the optimum fry output. The total Late Nadina River sockeye run was estimated at 11,200, of which 10,100 were produced by the spawning channel. This was the smallest run on this off cycle since 1964. In total, the channels produced 315,000 adult sockeye, from which a catch of 200,000 sockeye was obtained.

In the fall of 1980, 4,863,000 eggs were taken at Upper Pitt River for the incubation channel even though the number of spawners was only about half that in the brood year. At Weaver Creek the total number of sockeye spawners was substantially more than desired because of limitations on

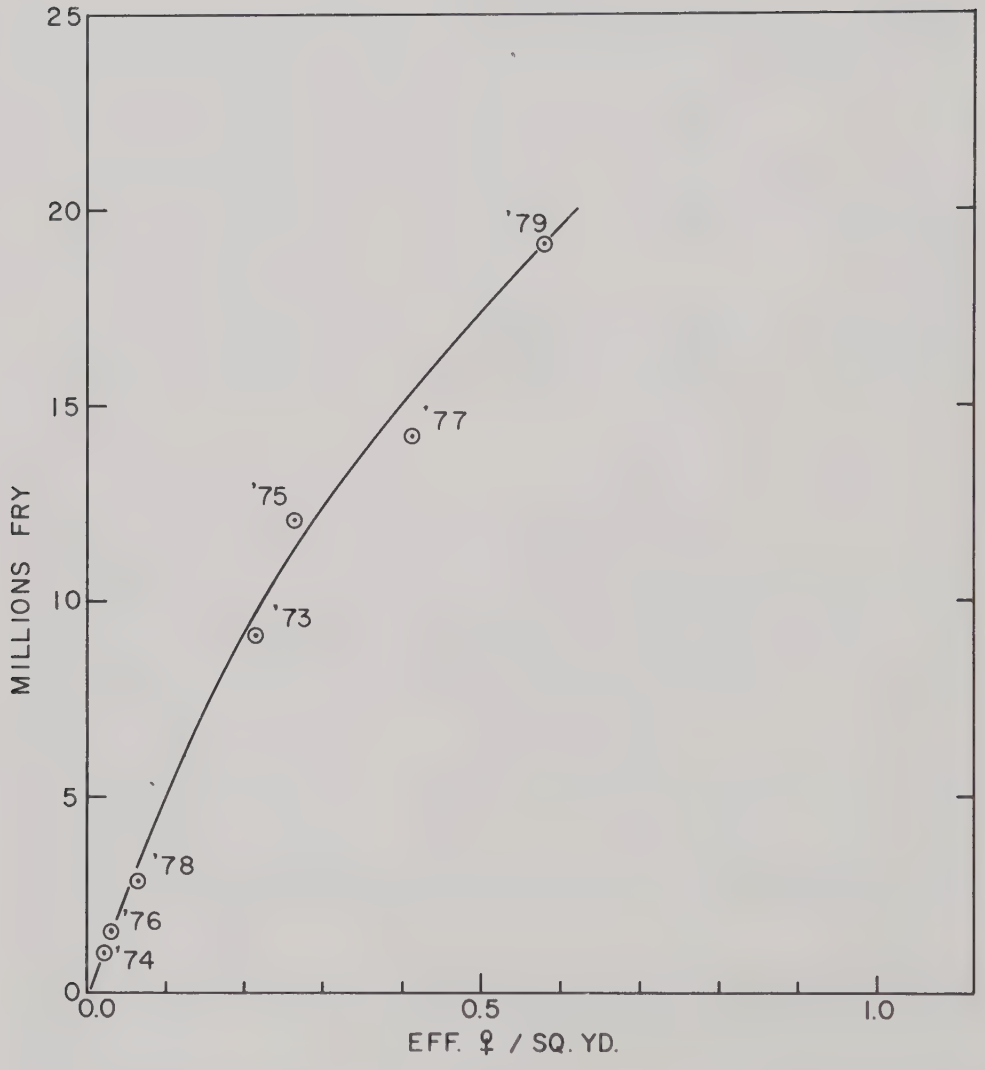

Figure 4. Relation between density of female sockeye spawners and fry production at Nadina River spawning channel.

the commercial harvest imposed by the Canadian Government for conservation of chinook salmon. The spawning channel received the largest number of spawners (41,595 adults) in any year so far, and the density of spawners, estimated at 1.31 females per sq. yd., was the highest of any year to date. The effect of this high spawner density on egg to fry survival should be revealing. At Gates Creek channel, the number of sockeye spawners in 1980 was the largest in any year to date and the density of spawners, estimated at 0.95 females per sq. yd., was the highest of any year. The design capacity was originally estimated at 0.67 females per sq. yd., but based on experience at Weaver Creek channel it could be at least 1 female per sq. yd. At the Nadina River channel the number of spawners on this off cycle more than doubled to 2,960 adult sockeye in the first cyclic return. In total, the four channels had about 134 million eggs deposited compared to 98 million in the brood year 1976.

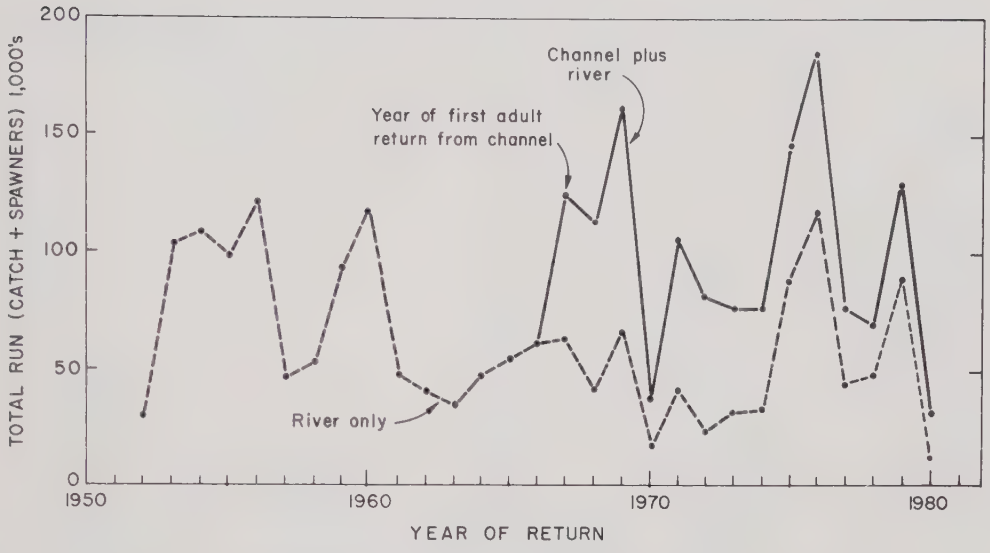

Figure 5. Sockeye production from Pitt River and Pitt River incubation channel, 1952-1980.

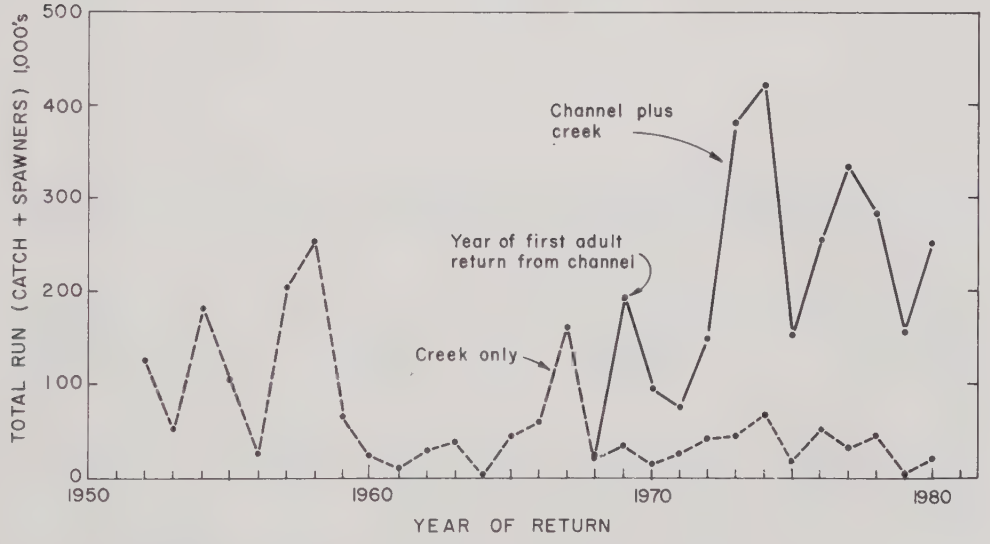

Figure 6. Sockeye production from Weaver Creek and Weaver Creek channel, 1952-1980.

REHABILITATION

Restoration of the once large sockeye run to the spawning grounds in Upper Adams River, tributary to Adams Lake in the Shuswap Lake system, has been an objective of the Commission for many years, starting with a fingerling transplant from Seymour River in 1949. Altogether 10 eyed egg transplants and 2 fingerling transplants were made between 1949 and 1975, totalling almost 10 million eggs and 171,000 fingerlings. The majority of the transplants were in the 1950 and 1951 cycles, but some were made in each cycle year.

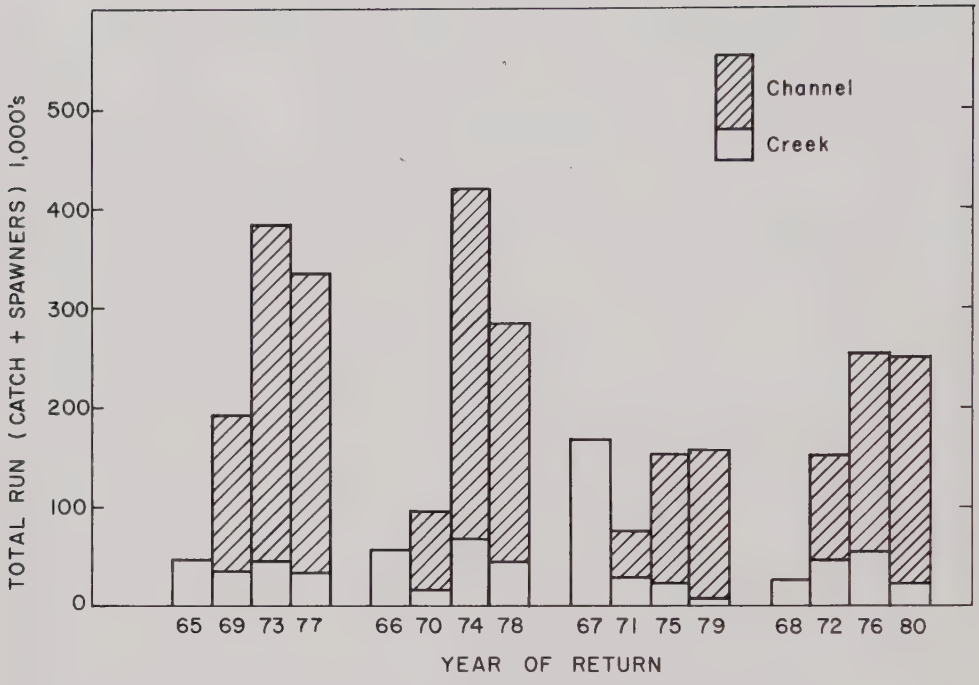

Figure 7. Sockeye production from Weaver Creek and Weaver Creek channel, by cycles, 1965-1980.

These transplants could be responsible for the small returns of spawners to Upper Adams River that have been observed starting in 1954, but the objective of restoring the Upper Adams run to its historic abundance has not been achieved (Table 4).

TABLE 4. Upper Adams River adult sockeye spawners.

1950 Cycle		1951 Cycle		1952 Cycle		1953 Cycle	
1954	194	1955	—	1956	9	1957	—
1958	291	1959	—	1960	P	1961	—
1962	79	1963	5	1964	162	1965	—
1966	63	1967	—	1968	—	1969	—
1970	4	1971	—	1972	31	1973	—
1974	13	1975	23	1976	40	1977	—
1978	—	1979	—	1980	560		

P — present

In the meantime, an early sockeye run has developed at the Momich River, another tributary of Adams Lake near the Upper Adams River. This run occurs primarily on the 1952 cycle (Table 5), the same cycle that produced the return to Upper Adams River in 1980. It is possible the two runs are related, although this has not been established. The spawning grounds available to the run to the Momich River are small and probably were fully utilized by the 1980 return. This stock therefore provides a source of eggs from within the Adams Lake system for further effort to restore the Upper Adams run. In the fall of 1980, approximately a half million eggs were taken from spawners

in Cayenne Creek, a tributary of Momich River. These eggs were flown to the Sweltzer Creek Research Laboratory for incubation. The fry will be returned to Adams Lake near Upper Adams River in the spring of 1981 where they will be fed and released.

TABLE 5. Momich River Early run sockeye spawners.

1950 Cycle		1951 Cycle		1952 Cycle		1953 Cycle	
1958	—	1959	—	1960	(a)	1961	—
1962	—	1963	0	1964	823	1965	—
1966	—	1967	—	1968	617	1969	—
1970	—	1971	—	1972	1,003	1973	—
1974	—	1975	0	1976	1,990	1977	11
1978	0	1979	0	1980	3,345		

(a) several hundred

Efforts to boost the production of sockeye from Cultus Lake continued for the third consecutive year. In the spring of 1980 approximately 394,000 Cultus sockeye fry were released to the lake following incubation of the eggs at the Sweltzer Creek Research Laboratory. The increased survival obtained from eggs to fry produces more fry than would be produced by the eggs in the natural spawning grounds on the lake shore. In the fall of 1980 another 250,000 eggs were taken for incubation. First adult returns from this program are expected in 1982.

RESEARCH

Research into the lacustrine biology of sockeye salmon continued in 1980. Pitt, Harrison, Cultus, Shuswap, Adams, Fraser and Francois Lakes were sampled for standing crop of zooplankton, water conductivity and transparency. Acoustic and trawl surveys were made of Pitt, Cultus, Harrison, Shuswap, Fraser and Francois Lakes at intervals during the year to assess the sockeye fingerling populations. A small closing net-midwater trawl was developed and tested to eliminate contamination of trawl samples with species of fish near the surface. This is particularly important when sampling Pitt and Harrison Lakes because of large numbers of smelt occupying the layers above the sockeye populations.

In cooperation with the University of Washington Fisheries Research Institute a dual beam echo sounder was used at Cultus Lake to assess its application in measuring target strength from sockeye fingerlings. Should this prove practical it could simplify the acoustic enumeration of sockeye in the lakes.

An experiment was carried out to test the effectiveness of marking fry by introducing the fluorescein compound DCAF (carboxynethy — Amio methyl fluorescein) into their food. This compound has been reported (Harkin 1978) to produce fluorescence in fish scales which can be used for identification. Approximately 6,000 fry weighing 0.5 grams were fed a diet mixed with DCAF solution for 1 week. Scales will be taken from these fry in the spring of 1981 to test for fluorescence.

In the 1978 Annual Report, reference was made to the bacterial disease vibriosis and the possible effect on sockeye and pink salmon. A new vaccine was tested on 25,000 marked Cultus

Harkin, D. G. New Fluorescent Fish Scale Marker. Prog. Fish Culturist V40 N4 October, 1978.

Lake sockeye smolts in the spring of 1978 to determine if it would improve the survival of the smolts. These fish returned to Cultus Lake in 1980 as adult sockeye, and 9 vaccinated fish were recovered compared to 6 unvaccinated fish. However, because survival of the marked fish was so poor the result is not significant.

The 1978 Annual Report also described research undertaken to examine the effect bypassing Anderson Lake would have on the survival of Gates Creek sockeye. Adult returns of the marked test fish are expected in 1981, but preliminary indications have been obtained from the return of jacks in 1980, as well as from sampling of smolts in the spring of 1979. Contrary to expectation, these data indicate that fry transferred from Gates Creek channel to Portage Creek connecting Anderson and Seton Lakes had poorer survival than fry that were not transferred.

Research into the use of environmental data in management forecasting has continued. Environmental data, partly salinity data from the west coast of Vancouver Island, were successful predicting the 1979 return of Fraser pink salmon. However, the influence of environment on the marine survival of Fraser River sockeye still is not well understood, and environmental data have not been as effective for forecasting as they have with pink salmon.

As outlined in the 1978 Annual Report, mid-ocean sea surface temperatures have been useful in the prediction of return timing of Fraser sockeye. Recently it has been found that summer coastal temperatures were a useful addition to the prediction model. Prediction of the return timing of the major Chilko River race of Fraser sockeye in 1980 worked out well for that minority of Chilko fish which returned via Juan de Fuca Strait. Detailed timing predictions were not made for other races, but approximate predictions proved to be fairly accurate for the races returning later than the Chilko sockeye, but were inaccurate for the early season sockeye races. Variations in the return timing among various Fraser stocks returning in the same portion of a season remain inexplicable, and study of this is continuing. The return timing of Fraser River pink salmon to the peak in the troll fishery seems to be well predicted by mid-ocean sea surface temperatures. However, the speed of passage of Fraser pinks from the troll to net fisheries seems to be more influenced by the coastal summer environment than the earlier mid-ocean environment.

Factors such as winter sea surface coastal transport, Fraser River discharge, coastal sea levels and early summer coastal sea surface temperatures have been used to attempt to forecast the proportion of the Fraser River sockeye run migrating through Johnstone Strait. On the basis of this information it was anticipated that in 1980 an above average proportion of Fraser River sockeye would come through Johnstone Strait.

However, the record 70% proportion that came that route in 1980 far exceeded expectation. Analyses are continuing to attempt to explain these variations in migration patterns. It was obvious from a comparison of the 1979 Fraser pink and sockeye returns that these two species do not necessarily show the same tendency to divert through Johnstone Strait in the same year. A study has also been started to analyze the environmental factors of possible importance in the return migration routes of Fraser pink salmon.

ENVIRONMENT CONSERVATION

The B.C. Pollution Control Board convened an inquiry in February, 1980 to examine whether compliance with provisions of the 1977 discharge permit for Annacis Island sewage treatment plant had been achieved. The Commission cooperated with the Department of Fisheries and Oceans and Environmental Protection Service in preparation of briefs to the inquiry which presented arguments favoring upgrading treatment to secondary.

Proposals announced in 1975 for extensive logging on the Nadina River watershed raised the possibility that road building and soil disturbance accompanying logging would cause above normal sediment loads on sockeye spawning grounds in the Nadina River. In response to these plans, the Commission initiated a water sampling program in September 1975 to establish background levels of water quality in the Nadina River and tributaries downstream of Nadina Lake before road building and tree removal commenced. Data collected in 1975, 1976 and 1977 represented baseline water quality. Suspended sediment in Nadina River was low and typical of other good quality spawning streams.

Construction of logging roads commenced in 1978, followed by more road building and logging in 1979 and 1980. In addition, proposals were made to extend logging to areas tributary to Nadina Lake. As a consequence, in 1978 water sampling was extended to tributaries of Nadina Lake to obtain background data. Monitoring in the Nadina River indicated suspended sediment levels at the downstream end were slightly higher after logging and road building commenced than they were in the baseline years of 1975-77. This result probably reflects the precautions taken as a result of activities of the Nadina Resource Committee referred to in the Engineering Division's report.

A propsal to develop a 2000 megawatt coal fired power plant in the Hat Creek area between the Thompson and Fraser Rivers has been under consideration by B.C. Hydro and Power Authority for several years. According to the conceptual design proposed in 1977 the plant would require a water supply of 25,000 to 40,000 gpm from the Thompson River to make up evaporative losses of recirculated cooling water. There would be no aqueous discharge to receiving waters. Screening of the water intake would be required to protect sockeye and pink salmon.

The proposed mine and generating plant at Hat Creek are subject to B.C. Pollution Control Objectives for this type of industry. These Objectives specify certain criteria for liquid and solid wastes. Furthermore, limits are specified for oxides of sulfur and nitrogen plus metals and other contaminants in gaseous emissions and ambient air. Gaseous emissions from the burning of coal are of concern because they contain oxides of sulfur and nitrogen which may give rise to abnormally acid precipitation downwind of the Hat Creek project.

When acidity caused by emissions is added to natural acidity, the possibility arises that neutralization capacity of the environment will be exceeded and gradual deterioration of the forest and aquatic ecosystems will occur. The Commission will be reviewing the proposals to ensure adequate protection of sockeye and pink salmon.

Expansion of the Northwood Pulp and Timber kraft pulp mill at Prince George from 744 to about 1600 tons per day moved ahead with completion expected in 1982. Although nominal pulp production capacity will more than double, effluent volume will increase only about 55% because of inplant improvements. To meet Level A Objectives when the expanded mill comes into production, the company plans to construct a second aerated lagoon to operate in parallel with the present one. When expansion is complete, treatment time in each lagoon is expected to equal eight days.

A thermomechanical pulp mill is under construction at Quesnel. The technical literature and tests in the Commission laboratory at Sweltzer Creek using effluent similar to that expected from the mill indicated that the effluent can be detoxified by treatment in an aerated lagoon. To meet Level A Objectives for detoxification, Quesnel River Pulp Company proposes five days treatment in an aerated lagoon before effluents are discharged to the Fraser River.

During the first half of 1980 treated effluent from the Cariboo Pulp and Paper kraft pulp mill at Quesnel periodically failed to meet Level A Objectives for detoxification. The mill undertook

corrective measures to control pH and prevent spills of black liquor and treated effluent met Level A detoxification objectives in the latter half of 1980.

Development of the Hemlock ski resort at the headwaters of Sakwi Creek entered a new phase when a new conceptual plan was presented to the B.C. Land Management Branch as a first step in obtaining a development agreement. Developments in Hemlock Valley are of concern to the Commission because Sakwi Creek is a tributary of Weaver Creek at the sockeye spawning area and forms part of the water supply for the spawning channel. The Commission, in cooperation with the Department of Fisheries and Oceans, reviewed and commented on the environmental guidelines proposed for the conceptual plan.

The access road to Hemlock ski resort is maintained by the Department of Highways. Although drainage works have reduced the amount of road subject to washout, further work is needed to protect Sakwi Creek from excessive sediment. Plans for corrective action by the Department of Highways are expected in 1981.

Surveys of dissolved oxygen and nitrogen were made in the Nechako River in August and October of 1980 to obtain reaeration coefficients required in assessing the Kemano II diversion of the Nechako River proposed by the Aluminum Company of Canada.

The aquatic weed, Eurasian water milfoil *(myriophyllum spicatum),* was removed from about 1.56 hectares (3.85 acres) of Cultus Lake by a diver operated suction dredge under a program sponsored by the Fraser-Cheam Regional District and the B.C. Ministry of Environment. The B.C. Aquatic Plant Management Section found there was a slight increase in total area infested by Eurasian milfoil but increase in density of plants was observed and owing to the limited control of Eurasian milfoil obtained by diver operated suction dredges, they recommended bottom barriers, mechanical removal and the herbicide 2,4-D should be considered for application in 1981. The Commission, in cooperation with the Department of Fisheries and Oceans will be reviewing control methods proposed to assure sockeye and pink salmon are protected. A survey by Commission personnel of Sweltzer Creek, which drains Cultus Lake, indicated there was no noticeable increase in Eurasian milfoil over that observed in 1979. The B.C. Aquatic Plant Management Section did not detect Eurasian milfoil in the Shuswap Lake system.

ENGINEERING

Protection of sockeye salmon from adverse effects of the existing Nechako diversion operated by the Aluminum Company of Canada (Alcan) required special measures during 1980. There have been low snowpacks in the Nechako watershed for the past 3 years and to conserve their water supply for power generation, Alcan reduced the discharge at the Skins Lake spillway, which discharges into the Nechako River (Figure 8), to only 450 cfs in November 1979. The Company announced that because power production was being limited by low reservoir elevation, the flow would remain at this low level until the reservoir had filled, which was not expected until after the spring of 1981.

The possible consequences for the 1980 adult sockeye populations were discussed with Alcan at a meeting in Kitimat in May. The Company could not give assurance that enough water would be discharged from the reservoir to ensure that the sockeye would not encounter lethal temperature conditions. The Minister of Fisheries issued an order in June requiring specific discharges for fisheries protection, but Alcan did not comply. The Minister subsequently issued a second order and sought a court order requiring Alcan to comply. The question was argued in the British Columbia Supreme Court and a judgment was given on August 5 directing Alcan to comply with

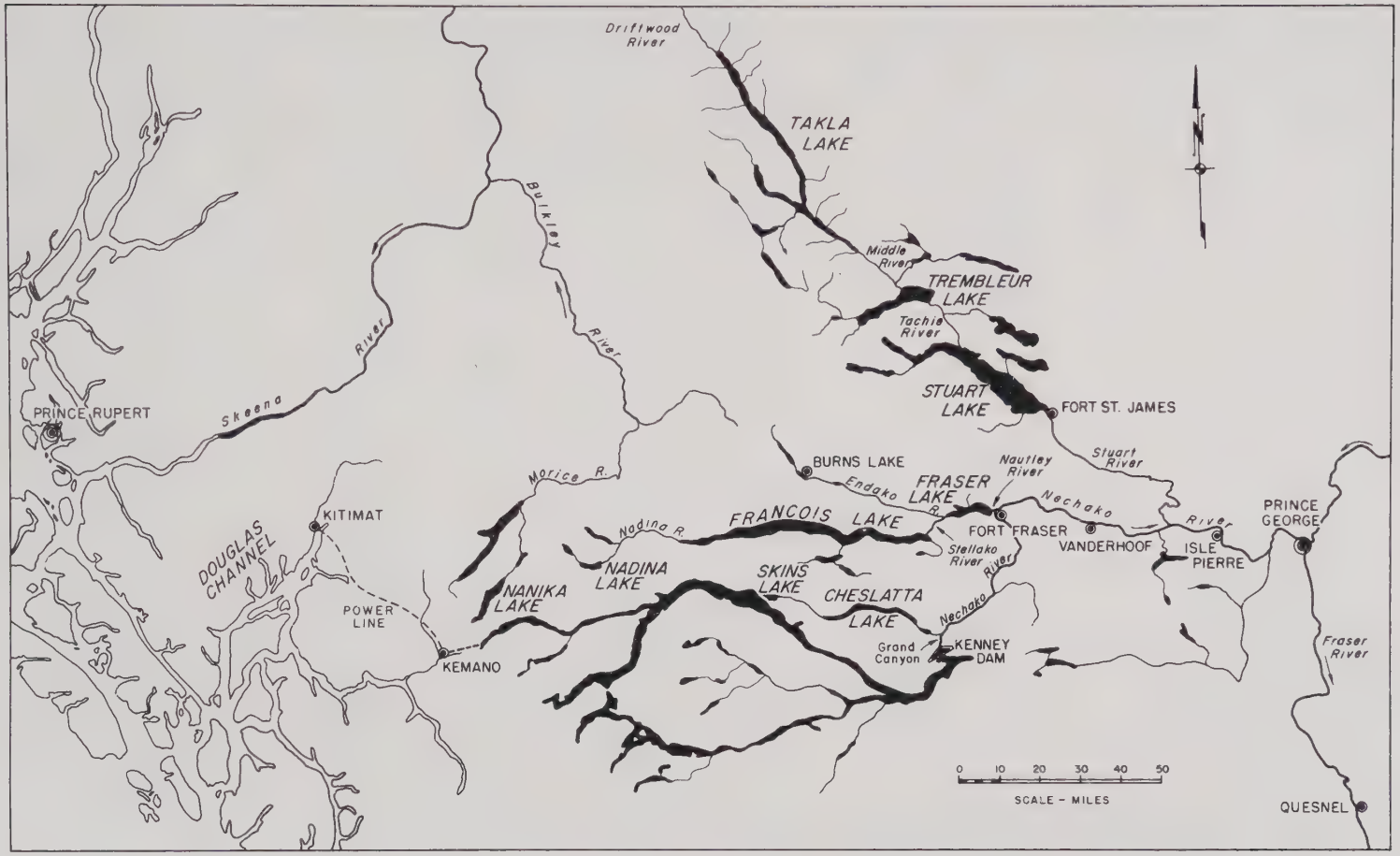

Figure 8. Nechako River system and the diversion to Kemano.

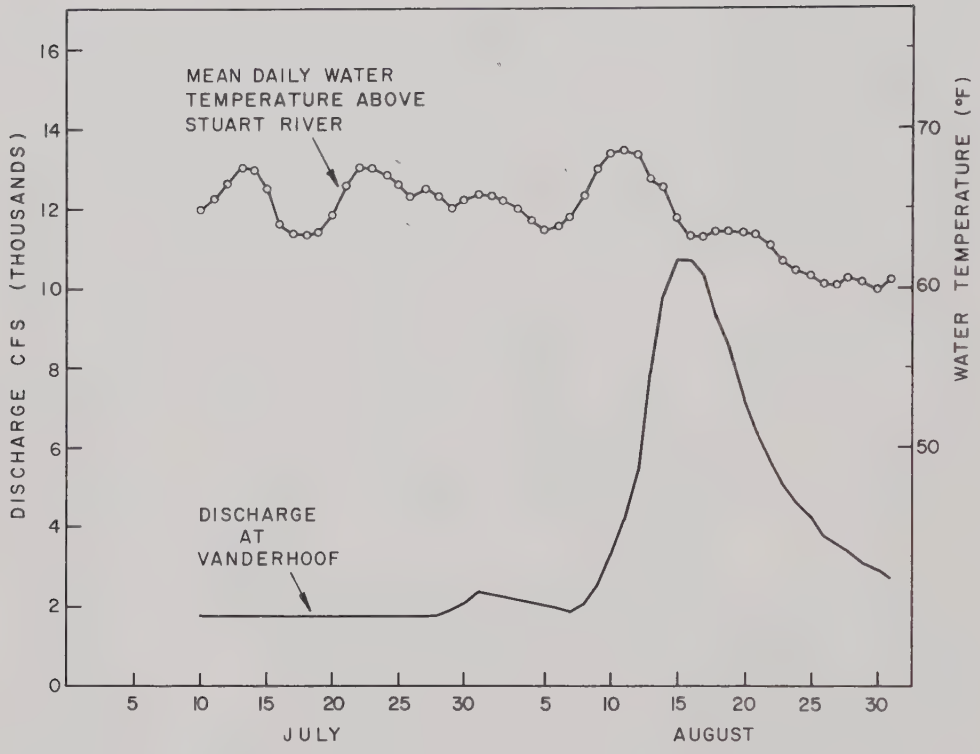

Figure 9. Discharges and water temperature of the Nechako River above the Stuart River confluence in the summer of 1980.

the Minister's order. This order specified a flow of 8000 cfs in the Nechako at the Cheslatta confluence until August 20 whereas up until August 5 Alcan had been spilling only 600 cfs.

Following the court judgment on August 5, Alcan immediately increased the spill to 8000 cfs. For 4 days commencing on August 9, this spill was increased to 16,000 cfs to obtain the stipulated requirement of 8000 cfs in Nechako River more quickly. The full effect of the required increase in discharge did not reach the critical section of Nechako River upstream from Stuart River until August 14 (Figure 9).

During this period mean daily temperature of the Nechako River above the Stuart confluence increased to 68.7° F on August 11. This was the highest mean daily temperature of the summer in this section of the river, but if the additional flow had not been provided, higher temperatures would have occurred.

As soon as it was apparent that the weather had cooled to such an extent that it was unlikely that the full 8000 cfs flow was needed any longer, Alcan was notified to reduce the spill to 500 cfs, which they did on August 16.

Changes in water temperature, discharge and water quality were measured throughout the sockeye migration route and radio telemetry was used to monitor the sockeye migration. Some of the sockeye destined for spawning areas in the Nechako system were captured and radio-tagged as they migrated up the Fraser near Quesnel and the radio signals from these tags were tracked daily by aircraft to determine if the fish were delayed at any point by temperature blocks as they migrated to their spawning areas.

The Early Stuart run migrated up the Nechako River to the tributaries of the Stuart system prior to the spilling of extra water from the reservoir and thus encountered a greatly reduced Nechako River flow. A prespawning mortality of 25% of the spawners occurred. This loss is larger than would have been expected on the basis of temperatures in the Fraser River at Hell's Gate. Maximum daily temperatures in the Nechako River above Prince George as high as 69° F were observed during the time of passage of this run, and this may have been a contributing factor to the loss at the spawning grounds. Except for the Late Nadina run, other Nechako sockeye runs which migrated up the river after the Early Stuart also had a mortality of 25% or more, about double the average for all Fraser sockeye in 1980, despite the additional flow provided. These losses are reason for concern about the factors affecting the health of these stocks and until they are understood fully, any adverse environmental change in the Nechako and Fraser Rivers must be regarded as potentially harmful to sockeye production.

The migration of sockeye smolts from Seton Lake was studied in the spring of 1980 in relation to operation of the Seton Creek hydroelectric installation in a continuing investigation that was partly funded by B.C. Hydro and Power Authority. Because of sporadic plant operation, the lake outlet discharge varied from 200-4200 cfs and this variation had a pronounced effect on smolt migration. Plant shutdowns at any time during the day greatly reduced the number of smolts migrating from the lake the following night. Further studies are required since protracted delay resulting from plant peaking operations may seriously reduce sockeye productivity by causing residualism or by reducing survival in the transition to the marine environment.

The problem of migration of adult sockeye into Seton Lake was also studied in 1980 to obtain further information on delay and loss of fish in the powerhouse tailrace. B.C. Hydro provided a temporary diversion of Cayoosh Creek into Seton Lake and radio telemetry was used to monitor the migration of Gates and Portage Creek sockeye. When the concentration of Cayoosh Creek water in Seton Creek was reduced to about 15%, significant improvements in passage of fish were observed. For Gates Creek sockeye, all of the radio-tagged fish released in the tailrace reached the spawning ground in apparently good condition. Portage Creek sockeye also appeared to reach their spawning ground in good condition but there was an unexplained delay of these fish at the tailrace averaging about 63 hours compared to only 10 hours for Gates Creek sockeye.

An experiment was conducted during the 1979-80 incubation period to investigate the feasibility of instream egg incubation boxes for unattended operation in isolated areas. Covered plywood boxes were placed in the Weaver Creek spawning channel with the tops of the boxes flush with the gravel surface and with controlled upwelling flow through a gravel layer in the boxes. The survival rate from green eggs to emergent fry averaged 84%. However emergence timing of the fry from the boxes was about one week later than in the spawning channel, and the fry were substantially smaller (26.56 mg dry weight) than fry produced in the channel (30.13 mg dry weight). Frequent valve adjustments were required to maintain the specified flow through the boxes.

Gravel cleaning is an essential maintenance procedure in the spawning and incubation channels used for Fraser River sockeye and pink salmon. The frequency of cleaning depends on the silt characteristics of the water supply, the effectiveness of silt removal facilities, and the amount of algae growth on the gravel. At the Upper Pitt River incubation channel, the gravel must be cleaned every year because the water source has a high silt load at times and the silt settling basin has a limited capacity. Gravel sampling showed that the Gates and Weaver channels also required cleaning prior to spawning of the 1980 populations. The work at Gates Creek was completed but there was so little flow in Weaver Creek during the summer months that the gravel washing machine developed by the Commission could not be used. The estimated cost of other possible gravel cleaning methods exceeded the funds available for the work.

Routine maintenance of the spawning channels, fishways and other facilities operated by the Commission continued. Remedial work was required again in Weaver Creek to excavate the stream bed and strengthen the banks of Sakwi and Weaver Creeks, because of extreme gravel deposition resulting from flooding and erosion in the fall of 1979. Further severe flooding occurred in December 1980 and additional work will be required in the spring of 1981 to contain the creek channel. There was no damage to the Weaver Creek spawning channel from either of these floods but additional measures to protect the channel were considered advisable. Fry enumeration facilities at the Weaver, Gates and Nadina channels were upgraded. Two steel barrier fences for controlling sockeye distribution were installed in Nadina channel and an electronic fish counter was installed at the channel entrance.

A number of proposed and ongoing land and water use developments and acitivities were examined during 1980 and recommendations made to the Department of Fisheries and Oceans for measures to protect sockeye and pink salmon stocks. Analyses of the possible effects on sockeye and pink salmon production of the proposed expansion of the Nechako-Kemano hydroelectric development continued. Possible consequences of this expansion were outlined in the Annual Report for 1979. The Commission participated with the Department of Fisheries and Oceans and the Nadina Resource Committee, which reviews proposals for logging, road construction and reforestation in connection with the harvest of timber in the Nadina River watershed, and makes recommendations to protect the environment on Nadina River. The Committee made field inspections of the operations in the spring and fall of 1980.

The increased volume of railway traffic in recent years has resulted in a proposal to double-track the Canadian National Railway from Jasper to Vancouver. This project would require extensive construction immediately adjacent to the North Thompson, Thompson and Fraser Rivers and potentially could have adverse effect on pink salmon spawning areas and on the migration of sockeye and pinks up these rivers. In conjunction with the Department of Fisheries and Oceans, possible methods of avoiding these adverse effects are being investigated and discussed with the Railway and its consultants.

Continuing proposals for placer mining, gravel removal from river bars, river dredging for navigation and construction of dykes and docks present potential problems in protection of the fisheries resource. Many applications for these activities were reviewed during the year and recommendations were made to the Department of Fisheries and Oceans to ensure protection of sockeye and pink salmon. River gravel supply sites were used in Vedder River and in the Fraser River at Seton Creek and near Chilliwack subject to conditions ensuring no interference with fish migration or spawning. Proposals for river bed excavation and dyking of Birkenhead and Lillooet Rivers were also reviewed and recommendations made to protect sockeye. Methods of avoiding interference with spawning and migrating fish were specified in connection with bridge construction over the Fraser River at Lillooet and Birkenhead River near Pemberton.

TABLE I

SOCKEYE CATCH BY GEAR

Gear		1968	1972	1976	1980
United States Convention Waters					
Purse Seines	Units	88	117	193	157
	Catch	464,544	533,179	669,322	189,899
	Percent	52.43	47.26	50.63	40.74
Gill Nets	Units	396	565	789	744
	Catch	354,760	506,406	628,411	263,138
	Percent	40.05	44.88	47.53	56.45
Reef Nets	Units	34	46	45	46
	Catch	66,404	88,304	23,869	13,050
	Percent	7.50	7.83	1.81	2.80
Troll	Catch	162	303	436	86
	Percent	0.02	0.03	0.03	0.01
TOTAL CATCH		885,870	1,128,192	1,322,038	466,173
Canadian Convention Waters					
Purse Seines	Units	46	47	101	39
	Catch	13,805	281,532	605,101	69,853
	Percent	1.50	26.04	43.77	15.31
Gill Nets	Units	1,410	1,004	722	591
	Catch	869,162	784,405	741,049	379,367
	Percent	94.46	72.55	53.60	83.17
Troll	Catch	37,125	15,280	36,334	6,938
	Percent	4.03	1.41	2.63	1.52
TOTAL CATCH		920,092	1,081,217	1,382,484	456,158

NOTE: Gear counts represent the maximum number of units delivering sockeye on a single day near the peak of the run.

TABLE II

CYCLIC LANDINGS OF SOCKEYE FROM CONVENTION WATERS

	United States	*Canada*	*Total*
1980			
Total Landings (No. Sockeye)	466,173	456,158	922,331
Share in Fish	50.54%	49.46%	
1946-1980			
Total Landings (No. Sockeye)	57,511,194	56,326,024	113,837,218
Share in Fish	50.52%	49.48%	
1980 *Cycle Catch*			
1980	466,173	456,158	922,331
1976	1,322,038	1,382,484	2,704,522
1972	1,128,192	1,081,217	2,209,409
1968	885,870	920,092	1,805,962
1964	508,087	514,548	1,022,635
1960	1,198,969	1,255,195	2,454,164
1956	906,872	894,836	1,801,708
1952	1,113,475	1,154,383	2,267,858
1948	1,089,091	752,691	1,841,782
1944	435,443	1,003,826	1,439,269
1940	654,091	1,033,000	1,687,091
1936	453,025	2,126,074	2,579,099
1932	853,406	733,735	1,587,141
1928	630,457	311,226	941,683
1924	772,056	442,250	1,214,306
1920	677,690	532,039	1,209,729
1916	909,425	376,891	1,286,316
1912	2,005,869	1,357,425	3,363,294
1908	1,879,268	870,612	2,749,880
1904	1,506,137	892,934	2,399,071

TABLE III

DAILY CATCH OF SOCKEYE, 1968-1972-1976-1980 FROM UNITED STATES CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1968	1972	1976	1980	1968	1972	1976	1980	1968	1972	1976	1980
1					95,135	104,974						194
2	749					78,450		13,772	3,109			2,511
3	223					57,077	188,368	12,907	2,239			991
4	24					229	107,849	48,224	1,796	106		614
5					3,291			7,651	1,076	213		85
6					69,286			8,604		190		
7					68,089	96				52		
8					50,987	26,887	312,686				754	188
9					57,251	264,096	220,219	33,988	772		235	481
10						100,648	112,490	55,003	702		407	194
11						67,670		62,389	146			82
12					82,039			34,997	143			3
13					24,597			16,088		53	381	
14	28				3,519	3,632				6	50	12
15	2,662				357	28,126				5	91	92
16	4,530	1						15,302	46			70
17	5,079	2,861						22,401	88			32
18		2,990						38,774	83	35		20
19		4,696	92,800		12,075			28,291	59	24		
20			50,093	7,998	9,103	2,809		19,145			96	
21	2,170			14,365	3,314	23,404		4,678			21	10
22	44,615			3,929	35	17,222					3	40
23	40,911	6,394		6,934		252			108		2	64
24	39,630	58,086							24			90
25	44,582	44,344							14	31		11
26		53,366	152,359		3,182				10	89		
27		50,708	82,055		4,458					879		
28					2,172	137				211	1	
29	15,711				33	65					1	555
30	96,552	7,840				55			20			813
31	86,860	116,110										
Totals	384,326	347,396	377,307	33,226	488,923	775,829	941,612	422,214	10,435	1,894	2,042	7,152
Troll	90	111	332	29	66	182	98	53				
Monthly Totals	384,416	347,507	377,639	33,255	488,989	776,011	941,710	422,267	10,435	1,894	2,042	7,152
June, Oct. & Nov. Totals									2,030	2,780	647	3,499
Season Totals									885,870	1,128,192	1,322,038	466,173

TABLE IV

DAILY CATCH OF SOCKEYE, 1968-1972-1976-1980 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1968**	**1972**	**1976**	**1980**	**1968**	**1972**	**1976**	**1980**	**1968**	**1972**	**1976**	**1980**
1	875					108,624					26,461	16,249
2	1,761					66,001	114,159		1,823		34,117	
3	2,481						331,770		5,017			
4								53,398	655	185		5,703
5					233,366				584	5,783		
6					57,248					35		
7	C					217,308					51,294	
8	L					76,235					12,709	5,383
9	O					84,294	101,107		748			3,752
10	S						84,325	35,465	3,800			
11	E							132,180	206	2,184		8,491
12	D				88,114	38,626						
13					25,694	153,479					3,512	
14					2,774	15,165						
15	3,565				83,013							
16	2,078						32,817		39			
17		4,546					18,006		2,360			7,164
18		4,142					54,068		13	8,694		
19			19,499		49,457			26,314				
20			11,614		4,318						1,806	
21				7,479	3,426	49,742						
22	29,390					15,006		30,586				
23	24,249					3,317	58,676		1,614			6,809
24		76,873					5,154		610			
25		71,895				13,362	23,660	32,551				
26			165,363		698		17,274	22,364				
27			124,928		518			10,783				
28				21,912	10,970	22,240		10,317				
29	160,129					1,531						
30	44,117					617	30,411		2,269			
31	28,164					5,376	486					
Totals	296,809	157,456	321,404	29,391	559,596	870,923	871,913	353,958	19,738	16,881	129,899	53,551
Troll	25,627	7,005	13,101	3,158	10,841	7,540	20,357	3,055	107	627	2,781	30
Spring Salmon Gill Nets	268	768	282							1,999	3,557	
Monthly Totals	322,704	165,229	334,787	32,549	570,437	878,463	892,270	357,013	19,845	19,507	136,237	53,581
June, Oct. & Nov. Totals									7,106	18,018	19,190	13,015
Season Totals									920,092	1,081,217	1,382,484	456,158

TABLE V

INDIAN CATCH OF SOCKEYE BY DISTRICT AND AREA, 1976 AND 1980

	1976		1980	
District and Area	*Catch*	*No. of Fishermen**	*Catch*	*No. of Fishermen**
HARRISON-BIRKENHEAD				
Birkenhead River and Lillooet Lake	7,500	1**	11,850	1**
TOTALS	7,500	1	11,850	1
LOWER FRASER				
Below Hope	50,289	430	53,673	483
TOTALS	50,289	430	53,673	483
MIDDLE FRASER				
Hope to Lytton	77,526	1,132	49,515	1,530
Lytton to Churn Creek	32,000		32,595	
TOTALS	109,526	1,132	82,110	1,530
CHILCOTIN				
Farwell Canyon to Siwash Bridge	39,466	199	16,267	149
Keighley Holes	4,357		755	
TOTALS	43,823	199	17,022	149
UPPER FRASER				
Churn Creek to Quesnel	8,565	160	2,182	198
Shelley	640	30	1,000	26
TOTALS	9,205	190	3,182	224
NECHAKO				
Nautley and Stella Reserves	5,702	74	13,589	97
TOTALS	5,702	74	13,589	97
STUART				
Fort St. James-Pinchi Village	1,046	47	2,532	54
Tachie, Takla & Trembleur Villages	1,185	65	1,325	114
TOTALS	2,231	112	3,857	168
THOMPSON				
Main Thompson	500	10	1,000	127
North Thompson	—	—	—	—
South Thompson	22	60	—	—
TOTALS	522	70	1,000	127
GRAND TOTALS	228,798	2,208	186,283	2,778

*Number of permits issued to Indians in district.

The Indian catch statistics detailed above are obtained from Canada Department of Fisheries and Oceans. Their officers control the taking of sockeye for food by the Indian population residing throughout the Fraser River watershed.

**One permit issued for entire Band, the permit is not included in grand total.

TABLE VI

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1968, 1972, 1976, 1980

District and Streams	1980 Period of Peak Spawning	Estimated Number of Sockeye					Sex Ratio Males 4-5 Yr.	Sex Ratio Females 4-5 Yr.
		1968*	1972*	1976*	1980	Jacks		
LOWER FRASER								
Cultus Lake	Nov. 15-20	25,736	10,660	4,450	1,687	30	693	964
Upper Pitt River	Sept. 12-16	16,988	13,412	36,530	17,135	34	7,788	9,313
Widgeon Slough	Oct. 29-Nov. 4	1,552	302	1,391	389	0	135	254
HARRISON								
Big Silver Creek	Sept. 12-18	1,090	2,552	1,642	610	61	317	232
Harrison River	Nov. 8-13	5,391	1,399	5,130	5,092	0	2,830	2,262
Weaver Creek	Oct. 24-28	2,606	15,505	22,867	33,244	576	12,183	20,485
Weaver Channel	Oct. 24-31	1,910	11,043	28,211	41,595	433	17,119	24,043
LILLOOET								
Birkenhead River	Sept. 21-27	83,750	113,097	108,121	90,922	12,309	35,009	43,604
SETON-ANDERSON								
Gates Creek	Aug. 30-Sept. 4	4,005	1,762	2,889	4,354	65	2,182	2,107
Gates Channel	Sept. 3-6	6,284	6,807	14,855	21,140	341	7,985	12,814
Portage Creek	Nove. 19-23	173	1,460	3,800	1,998	198	782	1,018
SOUTH THOMPSON								
Seymour River	Aug. 30-Sept. 2	3,957	2,889	8,489	8,390	81	3,531	4,778
Lower Adams River	Oct. 20-24	3,983	4,325	5,013	2,560	96	661	1,803
Little River	Oct. 20-23	0	81	175	32	16	8	8
Scotch Creek	Aug. 28-31	126	47	41	205	98	45	62
Upper Admas River	Aug. 27-30	—	31	40	560	0	200	360
Momich-Cayenne Creek	Aug. 26-29	617	1,003	1,998	3,345	0	1,548	1,797
NORTH THOMPSON								
Raft River	Aug. 29-Sept. 1	8,121	11,151	8,684	5,418	0	3,242	2,176
Barriere River	Aug. 30-Sept. 3	275	94	85	133	0	57	76
Fennell Creek	Aug. 28-Sept. 3	954	1,931	4,090	8,437	0	3,616	4,821
North Thompson River	Sept. 15-18	—	465	500	36	0	18	18
CHILCOTIN								
Chilko River	Sept. 20-29	414,446	564,465	364,311	468,658	846	169,437	298,375
Chilko Lake-South end	Early Sept.	Present	2,132	23,156	30,168	221	12,782	17,165
Taseko Lake	Mid Sept.	—	2,287	634	679	0	290	389
QUESNEL								
Horsefly-McKinley Creek	Sept. 10-15	5,686	3,385	2,064	3,162	2,854	154	154
Mitchell River		4	85	101	14	14	0	0
Little Horsefly River		73	18	32	0	0	0	0
NECHAKO								
Endako River	Early Sept.	18	27	40	25	0	12	13
Nadina River (Early)	Aug. 26-29	902	827	101	205	0	92	113
(Late)	Sept. 25-29	1,496	2,702	279	58	1	26	31
Nadina Channel	Sept. 18-21	—	—	1,394	3,021	61	1,328	1,632
Nithi River	Late Aug.	20	58	0	54	0	27	27
Ormonde Creek		81	54	30	0	0	0	0
Stellako River	Sept. 24-28	30,420	36,771	150,741	72,073	23	32,907	39,143
STUART								
Early Runs								
Forfar Creek	July 27-31	149	835	1,249	2,328	11	962	1,355
Gluske Creek	Aug. 1-5	18	591	966	1,049	10	499	540
Kynoch Creek	July 27-Aug. 1	833	2,534	6,727	10,661	37	4,481	6,143
Narrows Creek	July 30-Aug. 3	41	104	244	257	0	143	114
Rossette Creek	July 28-Aug. 1	518	834	2,090	2,054	20	726	1,308
Takla Streams	Aug. 9-13	0	143	1,120	428	9	179	240
Misc. Streams	July 27-Aug. 1	28	15	252	249	0	91	158
Early Stuart Totals		(1,587)	(5,086)	(12,648)	(17,026)	(87)	(7,081)	(9,858)
Late Runs								
Kazchek Creek		33	65	33	0	0	0	0
Middle River	Sept. 20-23	288	972	330	198	33	66	99
Tachie River	Sept. 20-23	149	7,527	2,637	756	0	378	378
Late Stuart Totals		(470)	(8,704)	(3,000)	(979)	(33)	(456)	(490)
NORTHEAST								
Upper Bowron River	Sept. 7-11	3,634	4,138	2,250	2,894	0	1,385	1,509
TOTALS**		626,706	830,128	823,453	848,320	18,566	326,789	502,965

*Numbers for some populations have been revised from the respective Annual Reports.
**Totals include small numbers of fish in small tributaries not listed in the table.

TABLE VII

DAILY CATCH OF SOCKEYE, 1965-1969-1973-1977 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1965**	**1969**	**1973**	**1977**	**1965**	**1969**	**1973**	**1977**	**1965**	**1969**	**1973**	**1977**
1		6,906					242,792	14,338			12,031	13
2		4,731	110,423		3,137					4,142	7,085	
3			80,632		1,445	122,566				3,683	3,912	
4			75,761		52,146	77,758						
5	26,335			230,143	65,290	63,332						302
6	21,773			98,478				12,777				15
7		1,824		18,638				145,053	932			
8		1,931		39,389			249,821	3,031	358	18		
9		2,324	15[illegible],802		55,149			41,953	181	78	1,429	
10			78,082		30,297			1,060		981	484	
11			77,654		14,893	42,399				266	126	
12	20,836		60,972			18,044						
13	15,456		47,993			15,558			62			
14		16,173		119,339		12,433	102,899	2,723	16			
15		9,948					39,203	61,433	0	191		
16			85,708		13,584			31,546	0	30		18
17			40,820		8,584					2	49	
18			43,260			17,370					22	
19	43,747					23,237						
20	74,983						84,981		20			22
21	84,674	221,188					58,765	776	23			1
22		156,203					33,417	17,032	57	98		4
23		182,627	120,363				10,132	7,411	40	699		
24			79,529	26,703				5,522		91	6	
25			69,739	386,882	7,728	19,605		82		41	9	
26				16,671	3,863	17,334		59				346
27							30,423		43			226
28	262,812	230,072					13,494		9			120
29	172,566	201,102						92	10	1,004		
30		92,332	287,354	15,296				5,446	0	294		
31			279,495	241,105				1,414				
Totals	723,182	1,127,361	1,691,587	1,192,644	256,116	429,636	865,927	351,748	1,751	11,618	25,153	1,067
Troll	104	131	285	377	46	210	108	492	1	1	1	0
Monthly Totals	723,286	1,127,492	1,691,872	1,193,021	256,162	429,846	866,035	352,240	1,752	11,619	25,154	1,067
June and October Totals									44,918	17,219	44,520	243,281
Season Totals									1,026,118	1,586,176	2,627,581	1,789,609

TABLE VIII

DAILY CATCH OF SOCKEYE, 1965-1969-1973-1977 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1965**	**1969**	**1973**	**1977**	**1965**	**1969**	**1973**	**1977**	**1965**	**1969**	**1973**	**1977**
1		10,842					140,333	254,774		1,272	2,157	205
2		10,654	77,811		206,017		108,960	49,889		709	1,489	
3			27,430		79,921						25,190	
4			16,248	216,751	29,092	178,581						
5	35,176			97,485		81,629						53
6	8,184		Strike			51,902	264,462	170,652				19,158
7			July 6-				50,062	45,446	133	286		
8			July 15				36,412	37,489	106	163		17,653
9		5,363	32,772		20,830		150,843	49,295	59	177	97	
10					63,820		61,480	66,984		287	11,213	
11					24,820	34,096					70	
12	19,440					62,362					37	25,675
13	5,750			68,514		15,882	57,682		27			
14		22,096		22,076			138,703		10			26,723
15			26,786				105,299	96,228	9			
16			12,961		9,770			11,790	11			
17			8,966		26,163					45	7,972	
18			10,905		4,618	8,471				16	4	
19	73,372					4,830					7	
20	22,946			95,756		13,310	93,807		4,335			
21	13,577	96,953		31,816			26,584		8			9,328
22		30,593					26,578	20,032	3			
23			243,444				11,668	2,928		15		
24			150,685					1,142		35	2,595	
25			112,045	351,221	6,790						22	
26				43,025	1,481	5,907					13,637	
27	179,102	368,974					31,894		18			
28	69,415	229,115					7,784		3			
29	76,955	160,326					11,313	5,771	3,182			
30	10,080	91,292	150,434		4,562	1,159				18		
31		79,400	215,403			1,160		369				
Totals	513,997	1,105,608	1,085,890	926,644	477,884	459,289	1,323,864	812,789	7,904	3,023	64,490	98,795
Troll	6,687	43,240	24,079	17,012	2,183	18,802	28,890	13,699	50	4,419	3,574	1,715
Spring Salmon Gill Nets		3,079							569	8,288	1,769	517
Monthly Totals	520,684	1,151,927	1,109,969	943,656	480,067	478,091	1,352,754	826,488	8,523	15,730	69,833	101,027
June, Oct. & Nov. Totals									29,921	29,788	46,414	99,982
Season Totals									1,039,195	1,675,536	2,578,970	1,971,153

TABLE IX

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1965, 1969, 1973, 1977

District and Streams	1977 Period of Peak Spawning	Estimated Number of Sockeye			
		1965	1969	1973	1977
LOWER FRASER					
Cultus Lake	Nov. 15-20	2,532	6,739	858	353
Upper Pitt River	Sept. 12-17	6,981	25,084	11,928	13,887
Widgeon Slough	Oct. 29-Nov. 2	275	715	427	427
HARRISON					
Big Silver Creek	Sept. 23-30	593	85	270	349
Harrison River	Nov. 10-15	15,034	15,006	3,060	2,246
Weaver Creek	Oct. 11-18	13,539	41,857	27,807	22,105
Weaver Channel	Oct. 22-25	4,436	17,089	22,366	33,040
LILLOOET					
Birkenhead River	Sept. 21-28	30,008	64,527	139,295	43,139
SETON-ANDERSON					
Gates Creek	Aug. 23-Sept. 1	1,679	205	231	1,176
Gates Channel	Aug. 25-Sept. 1	—	676	668	1,713
Portage Creek	Nov. 9-10	2,108	1,040	4,272	7,974
SOUTH THOMPSON					
Seymour River	Aug. 28-Sept. 3	6,954	7,327	2,856	5,911
Scotch Creek	Aug. 28-Sept. 3	1,910	3,395	6,235	13,586
Lower Adams River	Oct. 15-18	55,041	45,908	33,312	57,964
Little River	Oct. 15-18	3,274	6,842	6,689	8,684
South Thompson River	Oct. 3-6	192	630	545	432
Lower Shuswap River	Oct. 10-15	583	1,703	7,452	14,695
Misc. Streams	—	439	236	0	0
NORTH THOMPSON					
Raft River	Aug. 28-Sept. 2	6,624	5,593	2,729	648
Barriere River	—	104	40	22	16
Fennell Creek	Aug. 27-30	—	52	205	355
North Thompson River	Oct. 1-4	—	—	—	1,372
CHILCOTIN					
Chilko River	Sept. 18-23	39,962	76,518	61,707	54,322
QUESNEL					
Horsefly River	Sept. 1-8	359,232	270,027	253,388	473,008
Mitchell River	Sept. 12-16	5,335	8,939	24,673	42,396
NECHAKO					
Nadina River (Early)	Sept. 7	3,884	8,541	2,705	1,453
(Late)	Sept. 16-19	11,293	27,898	7,951	610
Nadina Channel	Sept. 16-21	—	—	8,786	16,286
Nithi River	—	34	140	54	150
Stellako River	Sept. 23-29	39,418	49,341	30,755	23,452
STUART					
Early Runs					
Ankwil Creek	Aug. 3-7	2,806	15,795	21,790	6,287
Bivouac Creek	Aug. 5-8	401	952	1,884	952
Driftwood River	Aug. 3-9	4,221	37,028	131,172	54,568
Dust Creek	Aug. 3-10	1,584	3,595	17,850	16,200
Felix Creek	Aug. 5-10	1,404	5,879	7,465	2,160
15 Mile Creek	Aug. 5-8	74	209	1,090	452
5 Mile Creek	Aug. 4-7	40	902	2,408	907
Forfar Creek	Aug. 3-7	2,221	9,922	18,924	3,628
Forsythe Creek	Aug. 4-9	553	2,248	10,907	3,677
Frypan Creek	Aug. 4-9	275	3,145	5,799	4,383
Gluske Creek	Aug. 2-6	2,200	4,660	19,450	4,646
Kynoch Creek	Aug. 1-5	2,885	12,380	22,485	5,893
Leo Creek	Aug. 3-8	121	571	1,390	646
Narrows Creek	Aug. 5-9	1,377	5,746	5,726	2,844
Paula Creek	Aug. 5-9	79	791	2,787	918
Rossette Creek	Aug. 4-8	1,165	1,566	4,156	2,261
Sakeniche River	Aug. 5-9	4	691	4,175	288
Sandpoint Creek	Aug. 3-8	706	693	3,178	1,519
Shale Creek	Aug. 3-7	79	706	3,260	1,672
25 Mile Creek	Aug. 5-8	229	0	744	164
Misc. Streams	Aug. 2-12	621	2,336	14,013	3,952
Early Stuart Totals		(23,045)	(109,818)	(300,653)	(118,017)
Late Runs					
Kazchek Creek	Sept. 17-22	3,292	178	2,909	720
Kuzkwa Creek	Sept. 17-22	10,000	8,370	20,124	9,031
Middle River	Sept. 14-18	139,186	111,322	91,879	80,420
Pinchi Creek	Sept. 17-22	—	756	1,271	1,719
Tachie River	Sept. 16-20	62,469	86,431	97,445	54,282
Misc. Streams	Sept. 17-21	11	—	715	457
Late Stuart Totals		(214,958)	(207,057)	(214,343)	(146,629)
NORTHEAST					
Upper Bowron River	Aug. 28-31	2,660	3,872	4,700	2,500
TOTALS*		852,271	1,006,972	1,181,093	1,113,453

*Totals include small numbers of fish in small tributaries not listed in the table.

TABLE X

DAILY CATCH OF PINK SALMON, 1973-1975-1977-1979 FROM UNITED STATES CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1973	1975	1977	1979	1973	1975	1977	1979	1973	1975	1977	1979
1					4,907		1,040		360,059		17,172	
2	100								330,814	280,698		
3	140								206,254			306,247
4	152										1,641	59,389
5			220					14,791			152,848	
6			203				854	33,009			10,868	
7		307	71				8,841	34,056				
8		308	189		14,294		109			53,910		
9	1,067	324					8,300		294,472	32,018		
10	1,496						644		169,530			
11	2,615					19,933			66,887			
12	3,581					16,127						
13	3,818							42,539			219	
14		1,066			22,253	23,762	1,796	132,837		146,806		
15		840			15,311		46,828	113,410		132,744		
16	5,661		1,776	4,266			70,333			57,264	5,344	12,762
17	3,799		409	925					59,485		55	70,785
18	2,908			1,608		55,608			21,161			3,790
19						52,909		7,602			36	1,620
20					62,583	53,815		476,678			2,042	
21		8,328			59,992		23,559	478,797			1,623	
22		5,047		5,203	43,693		446,813	95,190			995	
23	6,729			13,237	20,293		246,590	345,863		12,387		
24	5,110		2,163	8,198			275,569	60,371	6,891	4,707		
25	4,251		4,015				21,322	28,794	3,242			
26			1,363			137,643	20,728	548,344			743	
27					249,269	91,649		457,938			780	
28		12,707			138,583			35,947			243	
29		8,891					9,689	347,355		2,431		
30	6,821	7,998	422	12,529			360,684	15,619		866		
31	5,114	8,130	4,657	3,019			250,303	12,722				
Totals	53,362	53,946	15,488	48,985	631,178	451,446	1,794,002	3,281,862	1,518,795	723,831	194,609	454,593
Troll	7,108	7,881	40,202	34,918	5,704	11,946	118,162	224,700	598	956	4,394	2
Monthly Totals	60,470	61,827	55,690	83,903	636,882	463,392	1,912,164	3,506,562	1,519,393	724,787	199,003	454,595
June, Oct. & Nov. Totals									8,179	3,149	1,573	1,213
Season Totals									2,224,924	1,253,155	2,168,430	4,046,273

TABLE XI

DAILY CATCH OF PINK SALMON, 1973-1975-1977-1979 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1973	1975	1977	1979	1973	1975	1977	1979	1973	1975	1977	1979
1					3,396		12,490		167,083	33,756	50,134	
2					3,452		5,713		157,615	61,793		
3									157,578			
4	1		75			470						49,036
5						199				78,851	30,598	
6	Strike				24,136		1,433	75,235		74,730	108,270	
7	July 6-	50			14,643		23,843	499		50,627		
8	July 15				133,373		20,702			58,485	69,472	
9		11		66	2,572	186	24,390		39,434			
10					1,481	70	693		50,859			
11						165			36,599			
12						121		1,547	27,396		28,051	
13			172		23,520			119,176			1,279	
14		18			24,987			155,509		62,355	44,759	
15	40				38,368		207,768			45,604		
16	90			165			116,168	2,886		33,961		
17	84								58,070	29,163		6,309
18	59					6,347			12,299	58,966		3,678
19						11,200			7,441		548	
20			173		79,374	9,559		317,597			126	
21		243	152		71,878	14,836		240,369			9,285	
22		130			125,369	9,634	37,831	98,272		45,221		
23	7,155			182	10,591		136,178	2,467		2,800		
24	5,601	Strike					55,838		31,267			
25	4,415	July 25-	4,633			96,884		623,102	1,191	10,910		
26		Aug. 24	120			85,765		384,563	34,996			
27		712			178,434	94,303		244,486				
28		382			131,738							
29					28,293		3,685			11,317		
30	2,963			175				257,934		508		
31	3,472						87,617					
Totals	23,880	1,546	5,325	588	775,605	329,739	734,349	2,523,642	781,828	659,047	342,522	59,023
Troll	93,200	72,114	274,529	129,511	248,042	56,040	604,639	1,297,321	52,393	99,598	45,067	35,543
Spring Salmon Gill Nets									7,305	14,358	3,527	
Monthly Totals	117,080	73,660	279,854	130,499	1,023,647	385,779	1,338,988	3,820,963	841,526	773,003	391,116	94,566
June, Oct. & Nov. Totals									78,426	23,448	65,520	85,327
Season Totals									2,060,679	1,255,890	2,075,478	4,131,355

TABLE XII

SUMMARY OF THE PINK SALMON ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS

District and Streams	*1979 Period of Peak Spawning*	*Estimated Number of Pink Salmon* 1973	1975	1977	1979
EARLY RUNS					
LOWER FRASER					
Main Fraser	Oct. 4-11	766,053	315,049	775,016	1,521,856
FRASER CANYON					
Coquihalla River	Oct. 1-5	11,994	5,933	2,821	16,468
Jones Creek	Oct. 5-10	2,544	2,645	3,350	4,993
Misc. Tributaries	Sept. 27-Oct. 5	3,549	948	3,687	4,149
SETON ANDERSON					
Seton Creek	Oct. 12-15	181,027	209,734	341,256	549,512
Upper Seton Channel	Oct. 8-12	6,708	7,995	11,122	9,956
Lower Seton Channel	Oct. 8-12	23,602	23,874	37,163	34,494
Portage Creek	Oct. 7-10	13,983	28,454	19,904	51,842
Bridge River	Oct. 8-11	23,738	10,803	25,800	65,759
Gates Creek	Oct. 15-17	—	—	96	1,277
THOMPSON					
Thompson River and Tributaries	Oct. 4-17	283,385	480,350	972,941	885,402
TOTALS*		1,316,702	1,085,985	2,193,156	3,154,945
LATE RUNS					
HARRISON					
Harrison River	Oct. 15-20	196,150	180,052	126,782	269,858
Chehalis River	Oct. 12-16	14,300	2,356	2,613	2,067
Weaver Creek	Oct. 18-25	225	411	2,397	117
Weaver Channel	Oct. 15-18	640	1,201	963	737
CHILLIWACK-VEDDER					
Chilliwack-Vedder River	Oct. 12-20	210,799	81,137	48,561	124,041
Sweltzer Creek	Oct. 23-26	15,265	16,121	5,093	8,889
TOTALS*		437,409	281,278	186,409	405,709
GRAND TOTALS*		1,754,111	1,367,263	2,387,811	3,560,654

*Totals may include small numbers of fish in small tributaries not listed in the table.

COMMISSION PUBLICATIONS, 1980

1. Annual Report of the International Pacific Salmon Fisheries Commission for 1979.

2. Toxicity of butoxyethyl ester of 2,4-D to selected salmon and trout. Martens, D. W., R. W. Gordon and J. A. Servizi. Internat. Pacific Salmon Fish. Comm. Prog. Rept. 40. 18 pp.

INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

Advisory Committee Members
and Period of Service since Inception of the Commission

CANADA

Salmon Processors

Richard Nelson	1938-1966
Ken Fraser	1966-1971
Lloyd Monk	1971-1977
J. O'Connor	1977-1980
Brian Fraser	1980-

Purse Seine Fishermen

M. E. Guest	1938-1939
W. T. Burgess	1941-1945
George Miller	1945-1949
H. Martinick	1949-1950
W. J. Petrie	1950-1956
George T. Brajcich	1956-1957
C. N. Clarke	1957-1967
F. Buble	1967-1972
John Lenic, Jr.	1972-1973
John Brajcich	1973-

Gill Net Fishermen

F. Rolley	1938-1944
Homer Stevens	1944-1949
P. Jenewein	1949-1970
Frank Nishii	1970-

Troll Fishermen

W. A. Hawley	1938-1939
A. E. Carr	1944-1952
M. Berg	1952-1955
H. North	1955-1960
R. H. Stanton	1960-1969
M. Guns	1969-1971 1975-1979
W. Edwards	1971-1973
M. Ellis	1973-1975
John Makowichuk	1979-

Purse Seine Crew Members

H. Stavenes	1958-1975
Nick Carr	1976-

Sports Fishermen

M. W. Black	1938-1961
J. C. Murray	1961-1965
R. H. Wright	1965-1972
H. English	1972-1980
A. Downs	1980-

UNITED STATES

Salmon Processors

C. J. Collins	1938-1949
J. Plancich	1949-1972
D. Franett	1972-1980
J. Lind	1980-

Purse Seine Fishermen

L. Makovich	1938-1946
N. Mladinich	1946-1976
W. Green	1976-

Gill Net Fishermen

C. Karlson	1938-1958
J. F. Jurich	1946
J. Erisman	1958-1964
V. Blake	1964-1967
R. Christensen	1967-

Troll Fishermen

S. Leite	1938-1945
E. Larum	1939-1943
C. J. Dando	1946-1948
A. Anderson	1948-1949
J. R. Brown	1949-1957
B. J. Johnson	1958-1962
F. Bullock	1962-1966
C. Mechals	1966-1972
F. Lowgren	1972-1973
G. D. Simmons	1973-

Reef Net Fishermen

J. R. Brown	1958-1974
G. H. Schuler	1974-1978
T. Philpott	1978-

Sports Fishermen

K. McLeod	1938-1953
H. Gray	1953-1972
E. Engman	1972-

STAFF

A. C. Cooper, Director

NEW WESTMINSTER

F. J. Andrew, Chief Engineer
Dr. D. J. Blackbourn
O. T. Brockwell
P. Cheng
Mrs. M. Coventry (from July)
M. Fretwell
J. H. Gable
P. Gilhousen
Mrs. G. Grant
Mrs. E. M. Green
Mrs. S. A. Heiman (to March)
H. K. Hiltz
L. W. Johnston
R. B. Kent
S. R. Killick, Chief, Operations Division (to June)
D. C. Nelson (to March)
E. B. Phillips, Administrative Officer
J. Pyper (to April)
J. F. Roos, Assistant Director
W. S. Saito
Mrs. F. Sato
P. B. Saxvik
D. F. Stelter
R. A. Stewart, Chief, Operations Division
Miss B. Tasaka
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L. V. Woods

SWELTZER CREEK LABORATORY

D. P. Barnes
Miss D. R. Brock (to July)
P. M. Buck
R. J. Cooper
H. J. Enzenhofer
R. W. Gordon
R. L. Johnson
A. H. Lesberg (from September)
S. G. MacLellan
C. Mack
D. W. Martens
K. F. Morton
Miss S. Morelli
Dr. J. A. Servizi, Chief, Environment Conservation Division
E. R. Stewart
I. V. Williams, Chief, Biology Division

HELL'S GATE FISHWAYS — F. R. Johnston
UPPER PITT FIELD STATION — K. Peters
WEAVER CREEK CHANNEL — C. W. Miller
GATES CREEK CHANNEL — V. E. Ewert
SETON CREEK CHANNELS — M. King
CHILKO LAKE — F. G. Scott
NADINA RIVER CHANNEL — B. A. Van Horlick

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